**README**

Removing development incentives promotes climate adaptation (*Nature Climate Change*, 2024). Druckenmiller, Liao, Pesek, Walls, and Zhang

Updated June 2024

**Code**

The entire analysis is conducted in R. To run the replication scripts, please ensure that your directory is set to the code folder in the replication directory and you have the pacman package installed (this package will automatically install and the other required packages for you).

The four replication scripts are listed in the table below, along with their input and output files. Codebooks for each datafile are provided in the following section.

|  |  |  |
| --- | --- | --- |
| **Script** | **Inputs** | **Outputs** |
| 1\_synthetic\_control\_weights.R | data/matching\_data.csv  data/matching\_data\_ZTRAX.csv | data/synth\_weights.csv  output/Figure3a.pdf  output/ED\_Figure5.pdf  output/ED\_Figure3b.pdf  output/Table1.tex  output/Table\_ED1.tex  output/source\_data\_fig3a.csv |
| 2\_estimate\_direct\_effects.R | data/matching\_data.csv  data/direct\_outcome\_data.csv  data/synth\_weights.csv | output/Table2.tex |
| 3\_indvidual\_effects.R | data/matching\_data.csv  data/heterogeneity\_analysis\_data.csv | output/Figure3b.pdf  output/Table\_ED2.tex  output/Table\_ED3.tex  output/source\_data\_fig3b.csv |
| 4\_spillover\_effects.R | data/matching\_data.csv  data/spillover\_area\_data.csv  data/synth\_weights.csv | output/Figure4.pdf  output/source\_data\_fig4.csv |

**Data**

All data come from publicly available sources except the property-level transaction and assessment data from the Zillow Transaction and Assessment Database (ZTRAX), which we accessed through a license available to researchers. Data processing techniques are described in SI B.1. We provide five processed datasets required to replicate the main analysis: matching\_data.csv, matching\_data\_ZTRAX.csv, direct\_outcome\_data.csv, heterogeneity\_analysis\_data.csv, and spillover\_area\_data.csv. Two other datasets, synth\_weights.csv and individual\_effects.csv and generated as intermediate outputs. Codebooks for each dataset are provided below.

**data/matching\_data.csv**

**data/matching\_data\_ZTRAX.csv**

These datafiles contain the pre-policy data used to identify synthetic controls. The two datafiles are identical, except the \_ZTRAX file only contains the subset of units with non-missing property transaction and assessment data from ZTRAX.

|  |  |
| --- | --- |
| **Variable** | **Definition** |
| region\_id | Unique identifier for geographic unit |
| year | Year |
| bufa | Built-up surface area in unit, in m2 |
| bufa\_share | Built-up surface share in unit |
| Spillover\_bufa\_share | Built-up surface share in spillover area |
| Treated | Indicator for whether the unit is treated (1 for CBRS and post-policy) |
| CBRS\_unit | Indicator for whether this is a CBRS (1) or control (0) unit |
| wetland | Wetland area share in 1985 |
| barren | Barren area share in 1985 |
| treecvr | Tree cover share in |
| elevatn | Elevation in m |
| pre1982\_SUM | Number of buildings in unit built before 1982 |
| urban\_population\_mean | Urban population within commuting distance of unit |
| med\_hhincome\_p | Median household income in 1990 |
| A\_all\_share | Share of spillover land area covered by FEMA ‘A’ flood zones |
| V\_all\_share | Share of spillover land area covered by FEMA ‘V’ flood zones |
| region\_NorthAtlantic | Indicator = 1 if unit is located in the North Atlantic region |
| region\_SouthAtlantic | Indicator = 1 if unit is located in the South Atlantic region |
| region\_GulfCoast | Indicator = 1 if unit is located in the Gulf Coast region |

**data/direct\_outcome\_data.csv**

This data file contains the outcome data inside CBRS and control units (measured as close to 2020 as possible to estimate the long-term impact of the policy).

|  |  |
| --- | --- |
| **Variable** | **Definition** |
| region\_id | Unique identifier for geographic unit |
| in\_cbrs | Identifier for whether this is a CBRS (1) or control (0) unit |
| n\_buildings\_acre | Number of buildings per acre in 2020 |
| TotalAssessedValue\_acre | Total assessed value per acre in 2020 |
| LandAssessedValue\_acre | Land assessed value per acre in 2020 |
| ImprovementAssessedValue\_acre | Improvement assessed value per acre in 2020 |
| white\_acs | Share of population that is White in 2020 |
| black\_acs | Share of population that is Black in 2020 |
| med\_hh\_inc\_acs | Median household income in 2020 |
| occupied\_acs | Share of housing units that are occupied in 2020 |
| med\_rent\_pct\_acs | Median rent as a percent of income in 2020 |
| mean\_price | Mean property sales price, 2010 to 2021 |
| lotSizeAcres\_MEAN | Mean property lot size in 2020 |
| sqfeet\_MEAN | Mean property square feet in 2020 |
| TotalBedrooms\_MEAN | Mean property number of bedrooms in 2020 |
| barrier | Indicator for whether the units is a barrier island or cape |

**data/heterogeneity\_analysis\_data.csv**

This file contains the variables required for the heterogeneity analysis using individual treatment effects.

|  |  |
| --- | --- |
| **Variable** | **Definition** |
| region\_id | Unique identifier for geographic unit |
| State | State |
| wetland | Wetland share in 1985 |
| barren | Barren share in 1985 |
| elevatn | Elevation (m) |
| dst\_t\_c | Distance to coast (m) |
| land\_acres | Land area (acres) |
| med\_hhincome\_p | Median household income in 1990 |
| mean\_price | Mean property sales value (2010 to 2021) |
| pop\_density | Population density in 1990 |
| urban\_population\_mean | Urban population within commuting distance in 1990 |
| LCV\_1982 | League of Conservation Voters score in 1982 |
| total\_revenue | County-level total revenue |
| property\_tax | County-level property tax revenue |
| reliance | Property tax revenue as a share of total tax revenue (county-level) |

**data/spillover\_area\_data.csv**

This file contains the variables describing characteristics of the spillover areas.

|  |  |
| --- | --- |
| **Variable** | **Definition** |
| regin\_d | Unique identifier for geographic unit |
| dstnc\_b | Distance band (distance from CBRS boundary) |
| developed | Developed land area |
| other\_land | Other land classes area |
| water | Water area |
| wetland | Wetland area |
| barren | Barren area |
| land\_total | Total land area |
| wetland\_share | Wetland share |
| barren\_share | Barren share |
| cbrs | Indicator for CBRS (1) or control (0) spillover area |
| sfha\_land\_share | SFHA land area share |
| padus\_land\_share | PAD-US land area share |
| nbuild | Number of buildings |
| total\_nlcd\_area\_acre | Total land area (acres) |
| buffer\_500 | Indicator for in 0 to 500m band |
| buffer\_1000 | Indicator for in 500 to 1000m band |
| buffer\_1500 | Indicator for in 1000 to 1500m band |
| buffer\_2000 | Indicator for in 1500 to 2000m band |
| trt | Indicator for treated |
| nbuildings\_acres | Number of buildings per acre |
| barrier | Indicator for barrier island or cape |
| barrier\_type | Type: barrier island or cape |
| avg\_sales\_price\_amount | Average sales price |
| total\_land\_assessed\_value | Total land assessed value |
| total\_improvement\_assessed\_value | Total improvement assessed value |
| total\_assessed\_value | Total assessed value |
| avg\_lot\_size | Average property lot size |
| avg\_effective\_year\_built | Average property effective year built |
| avg\_sqfeet | Average property square footage |
| avg\_bedrooms | Average property number of bedrooms |
| total\_assessed\_value\_per\_acre | Total assessed value per acre |
| total\_improvement\_assessed\_value\_per\_acre | Total improvement assessed value per acre |
| total\_land\_assessed\_value\_per\_acre | Total land assessed value per acre |
| tot\_nfip\_area | NFIP SFHA area |
| tot\_nfip\_bldg | Number of buildings in FEMA SFHA |
| tot\_policyCount\_bldg\_weighted | NFIP policy count |
| tot\_claims\_per\_policy | NFIP claims paid per policy |
| tot\_claims\_per\_1000\_coverage | NFIP claims paid per $1000 coverage |
| tot\_claims\_per\_acre | NFIP claims paid per acre |
| tot\_claims\_per\_bldg | NFIP claims paid per building in SFHA |
| tot\_bldg\_per\_acre | Buildings per acre in SFHA |
| white | White share |
| black | Black share |
| hispanic | Hispanic share |
| bagrad | College graduate share |
| median\_hh\_income | Median household income |
| own\_occupied | Owner occupied housing units share |
| rent\_occupied | Renter occupied housing units share |
| occupied | Occupied housing units share |
| median\_rent | Median rent |
| median\_rent\_inc\_pct | Median rent as a percent of income |

**data/synth\_weights.csv**

This data file contains the synthetic control weights used in estimation (estimated in script 1).

|  |  |
| --- | --- |
| **Variable** | **Definition** |
| region\_id | Unique identifier for geographic unit |
| synth\_weight | Synthetic control weight (full sample) |
| synth\_weight\_ztrax | Synthetic control weight for the ZTRAX subsample |