



# **Documentation for Running the Microwave Jupyter Notebook and Generating Associated Documentation**

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VERSION 1.23.1-20230515-rc8



## Overview

Microwave is a Jupyter notebook designed to help companies comply with the auditing requirements of New York City’s Local Law 144. Specifically, Microwave performs the bias tests on model<sup>1</sup> outputs required by the law, as specified by the municipal Department of Consumer and Worker Protection’s (DCWP’s) April 2023 Notice of Adoption of Final Rule (available [here](#)) that has an effective date of July 5, 2023. Read the instructions below to learn more about using the Microwave notebook.

## Freely Available Cloud-Based Example

If you are not familiar with Python, Jupyter, and virtual environments, consider using our freely available cloud-based Microwave example available [here](#), which requires no installation.

The freely available cloud-based Microwave example relies on Google Colab and Workspaces, which requires that you have a Google account. If you would like to try the example, but do not have a Google account, you may follow instructions to create an account for free [here](#). Log into the new account; then access the freely available cloud-based example via the link above. If you are prompted with a warning that the “notebook was not authored by Google,” you will need to click “Run anyway” to continue using the web-based example.

## Local Installation

For users who are familiar with Python, Jupyter, and virtual environments and plan to install the Microwave notebook locally, please follow the installation and usage instructions in this document. **The installation steps on the next page are required for the notebook to function properly.**

**Support note:** Please reach out to [BNH.AI](#) Luminos support at [luminos@bnh.ai](mailto:luminos@bnh.ai) with any questions.

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<sup>1</sup> “Model” is used synonymously with “automated employment decision tool (AEDT)” in this document and the Microwave notebook.

## Quickstart Steps

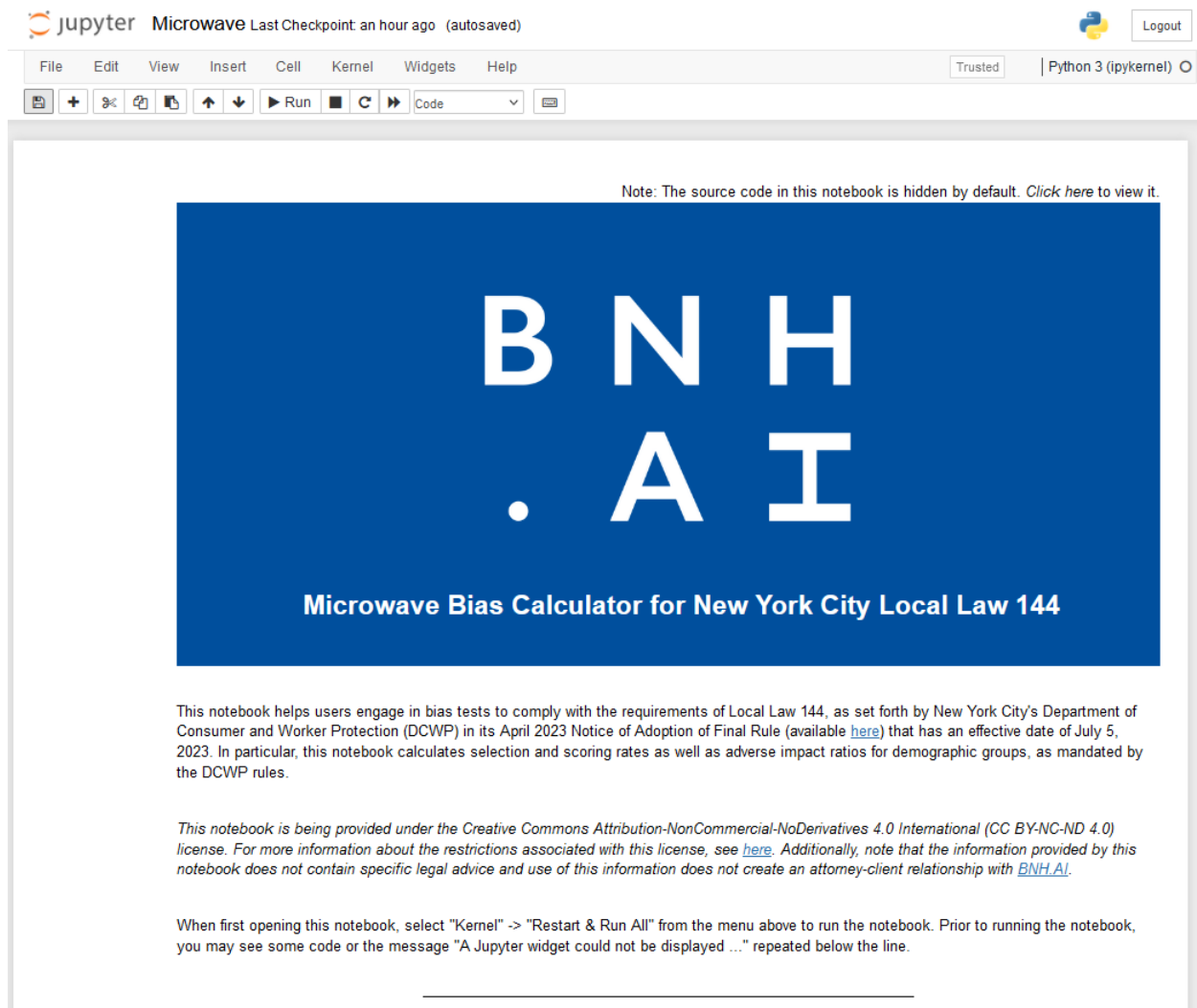
1. Download the zip file containing the Microwave notebook and associated artifacts by clicking on the hyperlink on the first bullet: “Microwave notebook v1.23.1 is available to download here.”
2. Unzip the downloaded zip file.
3. Run the setup file.
  - a. On Mac or Linux:
    - i. Open a terminal window. Change directories into the unzipped folder.
    - ii. Change directories into the `scripts` folder:  
`cd scripts`
    - iii. To start the notebook (for the first time and in the future), run: `./setup.sh`  
(You may need to run the following command to enable execution of the `setup.sh` file: `chmod +x ./setup.sh`)
  - b. On Windows:
    - i. Open a PowerShell window. Change directories into the unzipped folder.
    - ii. Change directories into the `scripts` folder:  
`cd scripts`
    - iii. To start the notebook (for the first time and in the future), run: `./Setup.ps1`  
(You may need to enable PowerShell scripts to run and to unblock `Setup.ps1` with the command `PowerShell -ExecutionPolicy Bypass -File Setup.ps1`)
4. Running the setup script should install a Python virtual environment based on `requirements.txt`, start a Jupyter notebook server, and open a browser tab.
5. In that browser tab, click on `microwave`, then `Microwave.ipynb`.
  - a. The first time you use the notebook, you may need to confirm that the kernel is trusted. You will then need to restart the kernel.
    - i. If Jupyter indicates the notebook is not trusted, click on: Not Trusted. Then click on: Trust.
  - b. Click on: Kernel. Then click on: Restart & Run All.
  - c. The notebook should now resemble a form-fill questionnaire and be ready for use.

**Support Note:** Python 3.9 with associated `distutils` package installed is preferred.

**Support Note:** If you are familiar with Python virtual environments, in place of running the setup script you may instead manually create a virtual environment, activate it, use `requirements.txt` to install the required dependencies, and start the `Microwave.ipynb` notebook. You may also need to trust the notebook, restart the kernel, and run all cells.

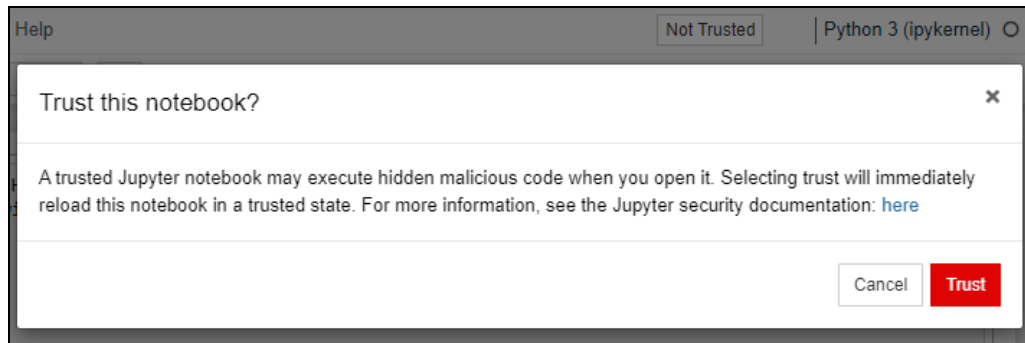
## Using the Notebook

Upon starting the notebook, you will see a header with the BNH.AI logo.



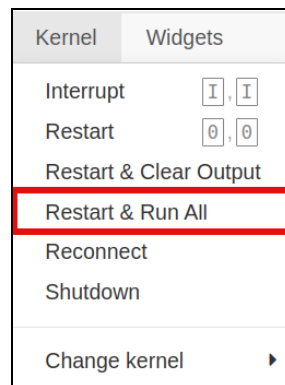
**Figure 1. Screenshot of Local Installation of Microwave Notebook**

Though the setup script should sign the notebook during the setup process so that it is trusted by Jupyter, if Jupyter indicates the notebook is “Not Trusted” the first time you use the notebook, you may need to click on the “Not Trusted” button and then the “Trust” button. See Figure 2.



**Figure 2. Trusting the notebook**

At this point, you will need to restart the kernel by selecting “Kernel” and then “Restart & Run All.” See Figure 3. Any code that may have been visible under the header will be hidden automatically. After restarting the kernel and running all cells, you will be presented with a basic interface to load data for bias testing.



**Figure 3. Using the Kernel Menu to Restart & Run All cells in the notebook.**

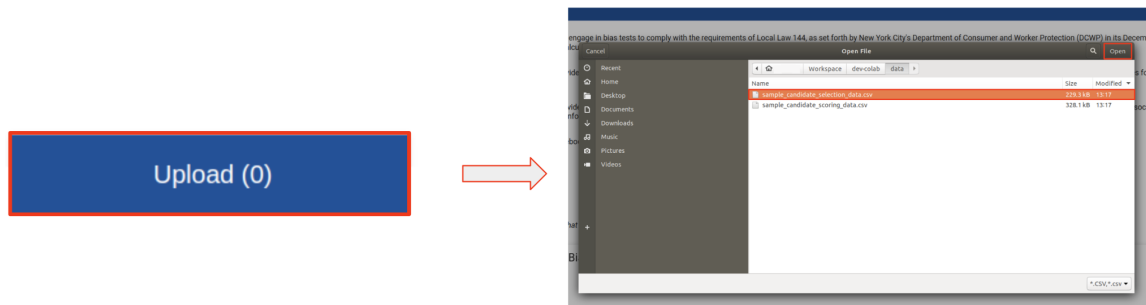
To conduct bias testing, the notebook requires a dataset with the following properties:

- The dataset must be in the form of a CSV file.
- The variable which contains the model output must either be a binary variable containing the value 0 or 1 (reflecting a binary classification or selection) or be continuously valued (reflecting a model used for scoring).
  - A variable encoding selection should use the value 1 to reflect selection (and 0 otherwise).
  - Increasing values of a variable that encodes scores are assumed to reflect more favorable results.
- The dataset must contain at least 100, but no more than 10,000, observations and be no greater than 10 MB in size.

- There must be at least two binary demographic variables that are indicators of race which encode demographic category membership with a value of 1 reflecting category membership (and 0 otherwise).
- The same applies for demographic variables that are indicators of sex.
- There may be no null values in the model output or demographic variables.

You may also refer to the sample datasets in the GitHub repository, available [here](#), for further guidance in verifying that the dataset is correctly formatted.

Once you have this dataset and know its location on your computer, click the blue Upload button and select the dataset for testing. See Figure 4.



**Figure 4. Using the Upload Button to select a dataset for bias testing.**

Once the dataset has been loaded, select the variable containing the model output. Column names are populated from the dataset you upload and may appear differently than in Figure 5.

**Please select the variable used to store the model output.**

**If using the sample data provided, select "Model Output"**

- ☐ Male
- ☐ Female
- ☐ Hispanic or Latino
- ☐ White
- ☐ Black or African American
- ☐ Native Hawaiian or Pacific Islander
- ☐ Asian
- ☐ Native American or Alaska Native
- ☐ Two or More Races
- ☒ Model Output

**Figure 5. Selecting the variable that contains model output.**

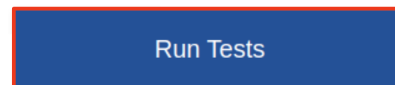
Then specify the names of the demographic marker variables in the dataset. Column names are populated from the dataset you upload and may appear differently than in Figure 6.

Please identify which variables encode sex category or race/ethnicity information. The variables should be binary, with 0 or 1 indicating category membership. If using the sample data provided, select "Male" and "Female" for the sex category and "Hispanic or Latino", "White", etc. for the race/ethnicity variables.

Variable Name	Race/Ethnicity	Sex Category
Male	<input type="checkbox"/>	<input type="checkbox"/>
Female	<input type="checkbox"/>	<input type="checkbox"/>
Hispanic or Latino	<input type="checkbox"/>	<input type="checkbox"/>
White	<input type="checkbox"/>	<input type="checkbox"/>
Black or African American	<input type="checkbox"/>	<input type="checkbox"/>
Native Hawaiian or Pacific Islander	<input type="checkbox"/>	<input type="checkbox"/>
Asian	<input type="checkbox"/>	<input type="checkbox"/>
Native American or Alaska Native	<input type="checkbox"/>	<input type="checkbox"/>
Two or More Races	<input type="checkbox"/>	<input type="checkbox"/>
Model Output	<input type="checkbox"/>	<input type="checkbox"/>

Figure 6. Selecting variables with demographic group markers.

Run the bias tests by pressing the blue Run Tests button.



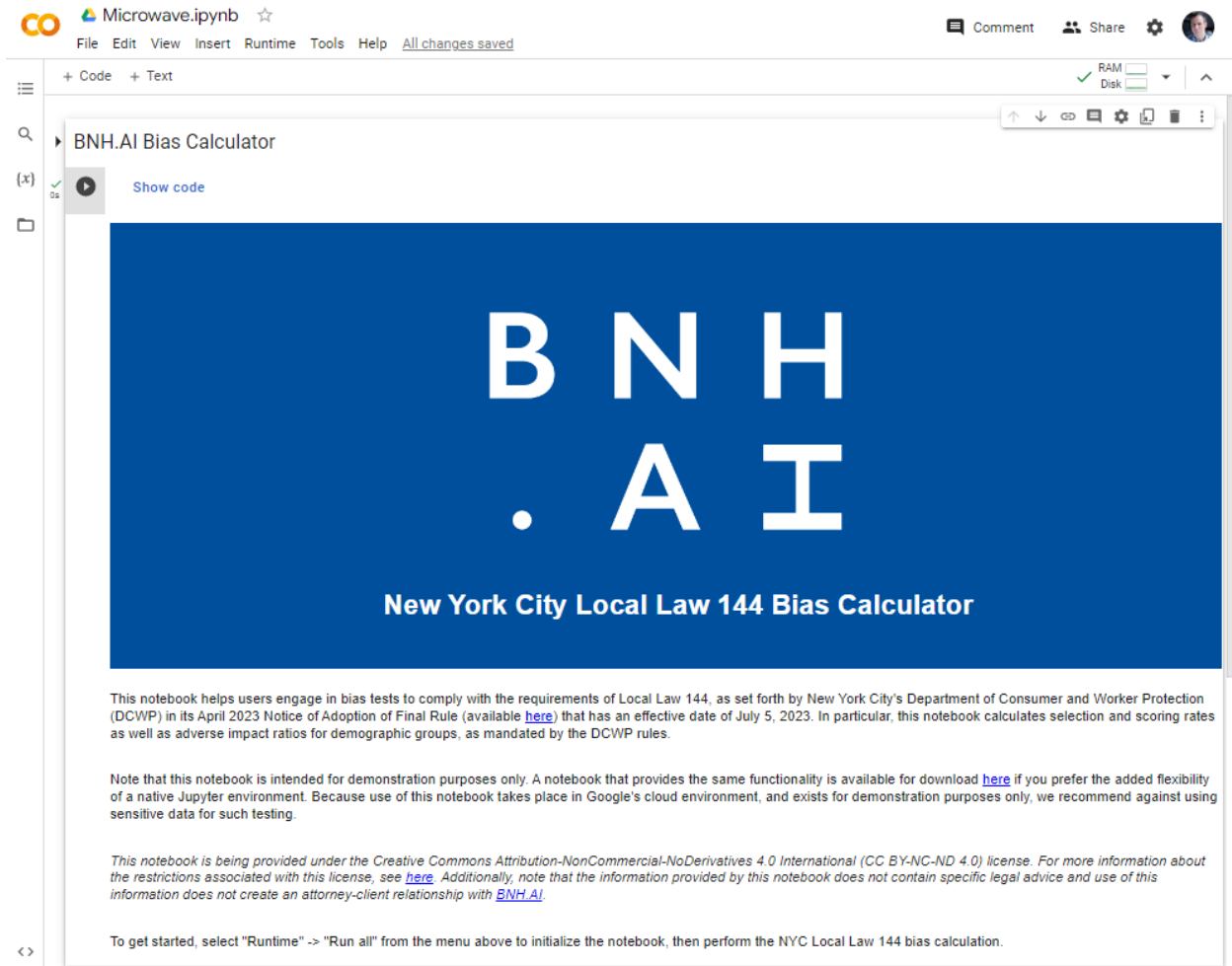
The notebook will then display the bias testing results aligned with the DCWP rules. Note that if any individuals assessed by the model were not included in the bias tests because they fall within an unknown category, the rules require the total number of such individuals to be indicated in the summary of the results. The rules also provide the independent auditor discretion to exclude the impact ratio of a category that represents less than 2% of the data being used for the bias audit provided that a justification for doing so is included in the summary of results.<sup>2</sup>

Note that the freely available cloud-based Microwave example available [here](#) has a similar look and feel (see Figure 7 below) and provides the same functionality as the locally installed native Jupyter notebook, but runs entirely in the cloud and requires no installation.

**Support note:** Should you have any questions or seek additional information related to any of the above, including legal and other implications of the test results, please reach out to BNH.AI Luminos support at [luminos@bnh.ai](mailto:luminos@bnh.ai).

**Disclaimer:** This notebook is being provided under the [CC BY-NC-ND 4.0](#) license.

<sup>2</sup> However, the selection rate or scoring rate, as applicable, still needs to be included in the summary of results for excluded categories.



**Figure 7. Screenshot of Freely Available Web-based Google Colab Microwave Notebook**