Homoscedasticity and heteroscedasticity

Homoscedasticity and heteroscedasticity are concepts related to the residuals (errors) in a regression model.

Homoscedasticity

- The variance of error is **constant** across all levels of the independent variables.
- **Purpose:** It's a key assumption in **linear regression** — required for:
    - Valid **hypothesis testing** (like t-tests and F-tests)
    - Accurate **confidence intervals**
    - Unbiased and efficient **OLS estimators**

Homoscedasticity is the desired condition.

Heteroscedasticity

- The variance of errors **changes** (e.g., increases or decreases) with the independent variable(s).
- It violates linear regression assumptions and can lead to:
    - **Inefficient estimates** (though still unbiased)
    - **Incorrect standard errors**, leading to invalid p-values
    - **Misleading conclusions**

So, **homoscedasticity is better** because it ensures your model's statistical tests and predictions are reliable.