

# Statistics and Data Analysis

## Unit 06 – Lecture 06: ADF Test for Stationarity

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<https://github.com/tali7c/Statistics-and-Data-Analysis>

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# Learning Outcomes

- State null and alternative of ADF test (unit root)

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- State null and alternative of ADF test (unit root)
- Interpret ADF p-value for stationarity decision
- Apply ADF to original and differenced series (idea)
- Explain why tests are not the only evidence (plots matter)

# ADF Test: Key Points

- H<sub>0</sub>: unit root (non-stationary)

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- H<sub>1</sub>: stationary

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- H<sub>0</sub>: unit root (non-stationary)
- H<sub>1</sub>: stationary
- Small p-value -  $\downarrow$  reject H<sub>0</sub>

# Interpretation: Key Points

- If non-stationary, difference and test again

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- Seasonality can require seasonal differencing

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- If non-stationary, difference and test again
- Seasonality can require seasonal differencing
- Use ACF/PACF + diagnostics too

# Exercise 1: ADF null

What is  $H_0$  in ADF?

# Solution 1

- Unit root; non-stationary.

## Exercise 2: Decision

If  $p=0.02$  at  $\alpha=0.05$ , what do you conclude?

# Solution 2

- Reject H<sub>0</sub>; evidence of stationarity.

## Exercise 3: Next step

If  $p=0.6$ , what next step?

# Solution 3

- Difference and test again; consider seasonal differencing.

# Mini Demo (Python)

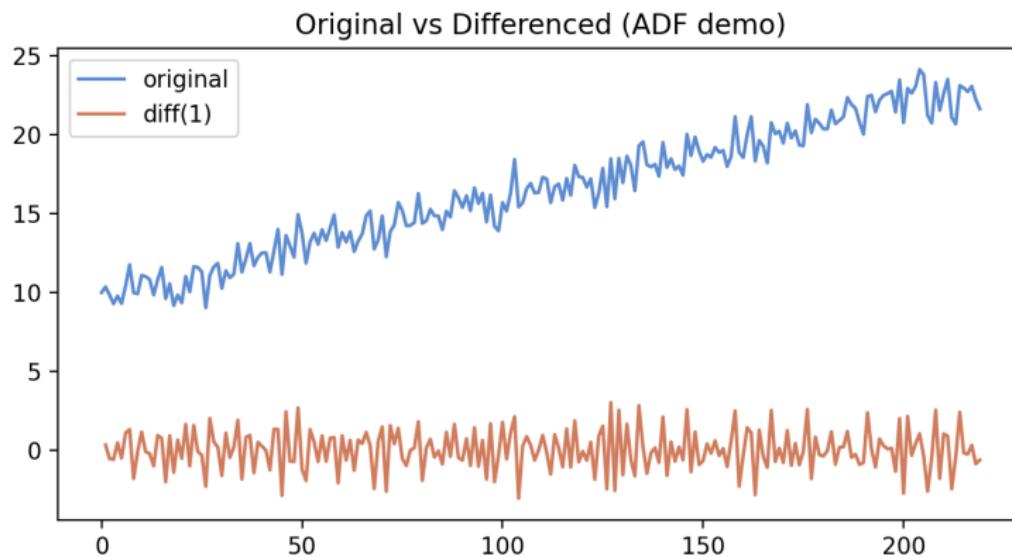
Run from the lecture folder:

```
python demo/demo.py
```

Outputs:

- images/demo.png
- data/results.txt

# Demo Output (Example)



# Summary

- Key definitions and the main formula.

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- How to interpret results in context.

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- Key definitions and the main formula.
- How to interpret results in context.
- How the demo connects to the theory.

# Exit Question

Why should we not rely on only one test to decide stationarity?