

# Final project

- Your class project is an opportunity for you to explore an interesting time series problem in the context of a real-world data set.
- Make sure you have data available and a clear roadmap
- You can work in teams of up to 3 individuals

## Project Timeline

- Project and group proposals: 21 November
- Project discussion with me: 15 December: 15 minutes slots per group
- Project hand-in: 15 January. You will hand in a set of maximum 40 slides about your project, along you all the codes and data to run them. Replication files should run seamlessly.
- Oral exam: 22 January. Prepare a short version of your slides to present to me in maximum 10 minutes. I will also ask questions, both about your project **as well as the course material**.

## Project Ideas

### Financial Time Series

**Stock Price Prediction.** Do basic time series forecasting methods have any predictive ability, perhaps on certain collections of stocks? Do they work for different asset classes? Price return time series exhibit peculiar features, so-called '*stylized facts*': heavy tailed return distributions, time varying (and persistent) volatility, slowly decaying autocorrelation function, and steady correlations between certain asset classes (like stocks and bonds). Can your methods for price prediction be adapted in light of these empirical facts?

**Stochastic Volatility** Can forecasting volatility, which is the variance of stock prices, be predicted? Higher volatility is useful for financial institutions as trading during those periods can mean increased opportunities; it also provides increased liquidity to exit out of large positions. Volatility is also intimately related with option pricing.

**Data Sources:** Google Finance, Yahoo Finance.

## Environmental Data

**Air Quality Index data.** Can you use the time series models to forecast AQI? How would you incorporate the spatio-temporal aspect of the data? Using AQI data in adjacent locations might help in time series forecasting; how would you incorporate this in your model? Can you use other information such as wildfire data or weather data to help forecast AQI?

**Global Temperature Forecasting.** Using historical temperature data, can basic time series methods quantify how unusual the past century of warming has been? Another aspect of the project is to forecast temperatures beyond the current year; can these be improved using auxiliary data such as human industrial activity, carbon emissions, or certain weather patterns?

### Data sources:

- <https://www.epa.gov/outdoor-air-quality-data>
- <https://climatedataguide.ucar.edu/climate-data/global-temperature-data-sets-overview-comparison-table>
- <https://statbel.fgov.be/en>
- <https://climate-adapt.eea.europa.eu/>

## Natural Language Processing

Text Data Time Series: Analyze the frequency of certain keywords or topics in text data over time, such as news articles or research papers. The analysis of central bank communication is a hot topic in monetary economics at the moment, so I have added some data sources about that.

### Data sources:

- <https://www.bis.org/cbspeeches/download.htm>
- <https://www.ecb.europa.eu/press/key/html/downloads.en.html>
- <https://www.kaggle.com/datasets/davidgauthier/central-bank-speeches/data>

## Economic Data

**Economic Forecasting:** Analyze time series data of economic indicators (GDP, unemployment rates, inflation) to forecast a series of interest. Consider what variables can help you forecast that series, based on economic theory, but also experimenting

with new data such as for example Google trends or textual data. And can you say anything about the causal links in your model?

- <https://data.ecb.europa.eu/>
- <https://fred.stlouisfed.org/>
- <https://www.imf.org/en/Data>
- <https://data.worldbank.org/>

## **Energy Consumption**

**Load Forecasting:** Analyze historical electricity consumption data to predict future demand and optimize resource allocation.

**Renewable Energy Generation:** Study time series data of solar or wind energy production for forecasting and efficiency optimization.

### **Data sources:**

- <https://www.iea.org/data-and-statistics>
- ...