

# 1.1 - The Nature of Time Series Data

Time series data is useful in several applications. Here we will discuss notable examples from the textbook.

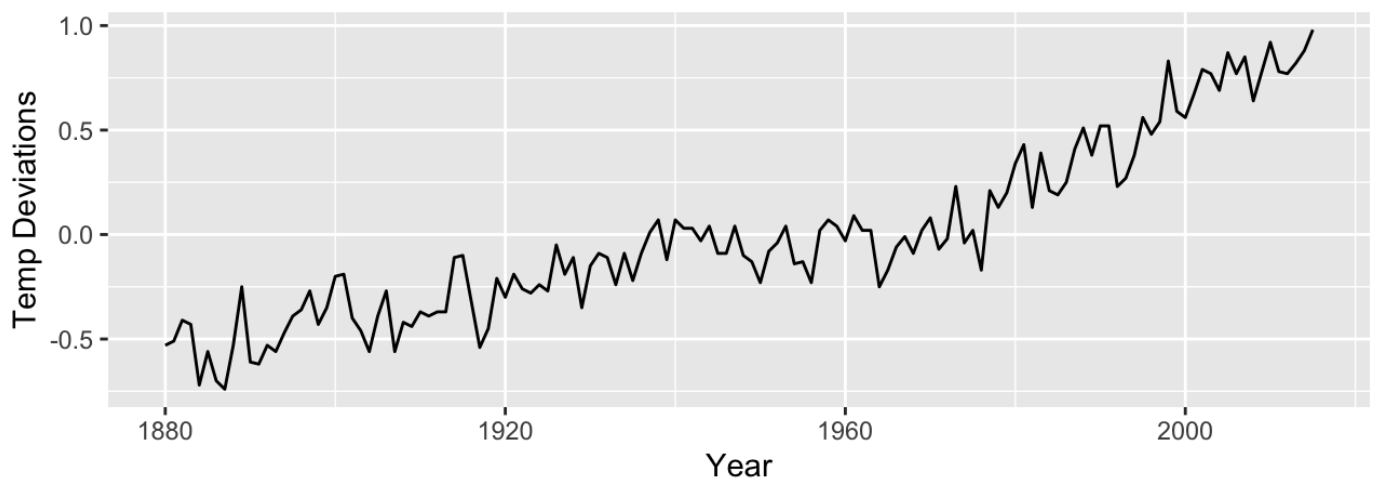
## Global Warming

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This example is notable because it gives a preview of how time series data is not always a "direct" source, such as monthly average temperatures or daily closing stock prices. Here our data are relative to some "anchor" point, making finding a pattern easier compared to raw temperature data.

```
library(tidyverse)
library(ggfortify)

autoplot(globtempl, xlab = "Year", ylab = "Temp Deviations")
```



## Returns on the Dow Jones Industrial Average

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This example follows from the previous one. Instead of plotting the DJIA directly, we first perform the following calculations to get data we want to plot:

$$\text{Return}_t = r_t = \frac{x_t - x_{t-1}}{x_{t-1}}$$

$$1 + r_t = \frac{x_t}{x_{t-1}} \implies \ln(1 + r_t) = \ln\left(\frac{x_t}{x_{t-1}}\right) = \ln(x_t) - \ln(x_{t-1}) \approx r_t$$

```
library(xts)

djiR<-diff(log(djia$Close))[-1]
autoplot(djiR, xlab = "Time", ylab = "Return")
```