Lecture 12

Understanding and Reporting Trends Over Time

Thought Question 1:

What do you think is meant by the term *time series*?

Thought Question 2:

What do you think it means when a monthly economic indicator, such as new housing starts, is reported as having been *seasonally adjusted*?

Thought Question 3:

If you were to plot number of ice cream cones sold versus month for 5 years, do you think the plot would show peaks and valleys, or would sales be relatively constant across all months?

Explain.

Thought Question 4:

If someone is trying to get you to invest in his or her company and shows you a **plot of sales** or **profits** over time, **what features** of the picture do you think you **should critically evaluate** before you decide to invest?

15.1 Time Series

Time series: record of a variable across time, usually measured at equally spaced time intervals.

Source: Hand et al., 1994, p. 314.
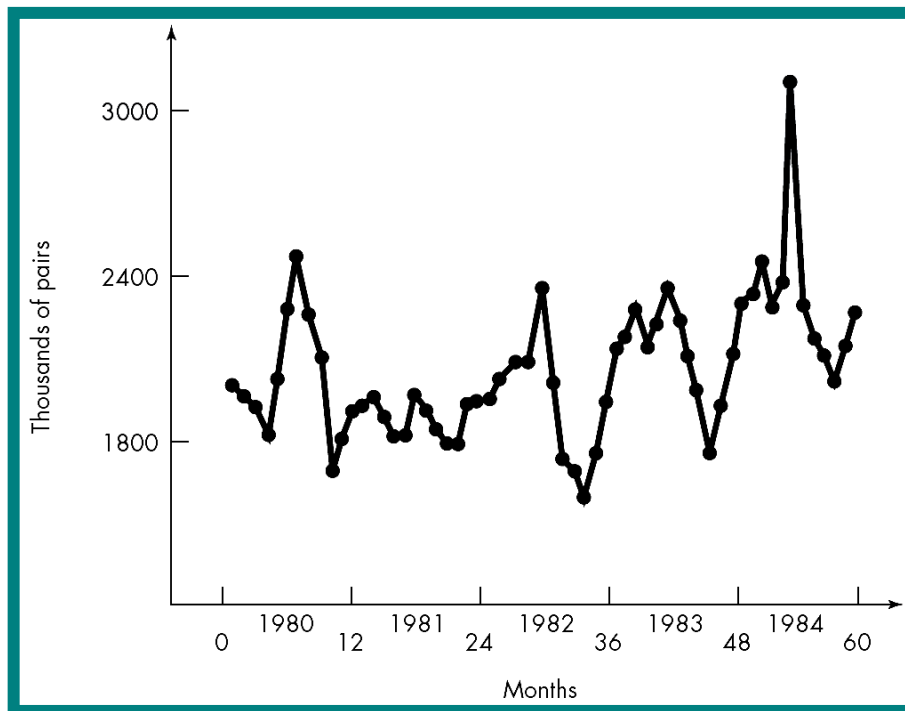
Time series plot:
Jean sales in the United Kingdom from 1980 to 1984.
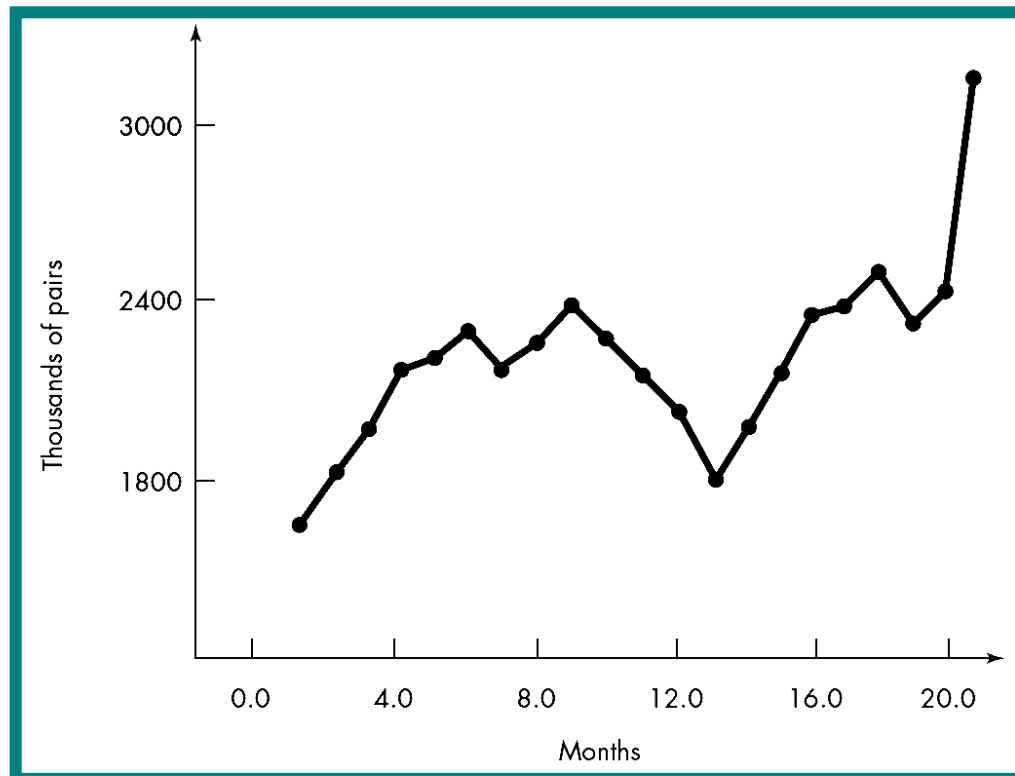
Data points connected so easier to follow ups and downs across time.

Improper Presentation of a Time Series

Using a subset of the data or
      starting the plot at an advantageous point.

**Jeans sales for
21 months**

*Distortion caused by
displaying only part
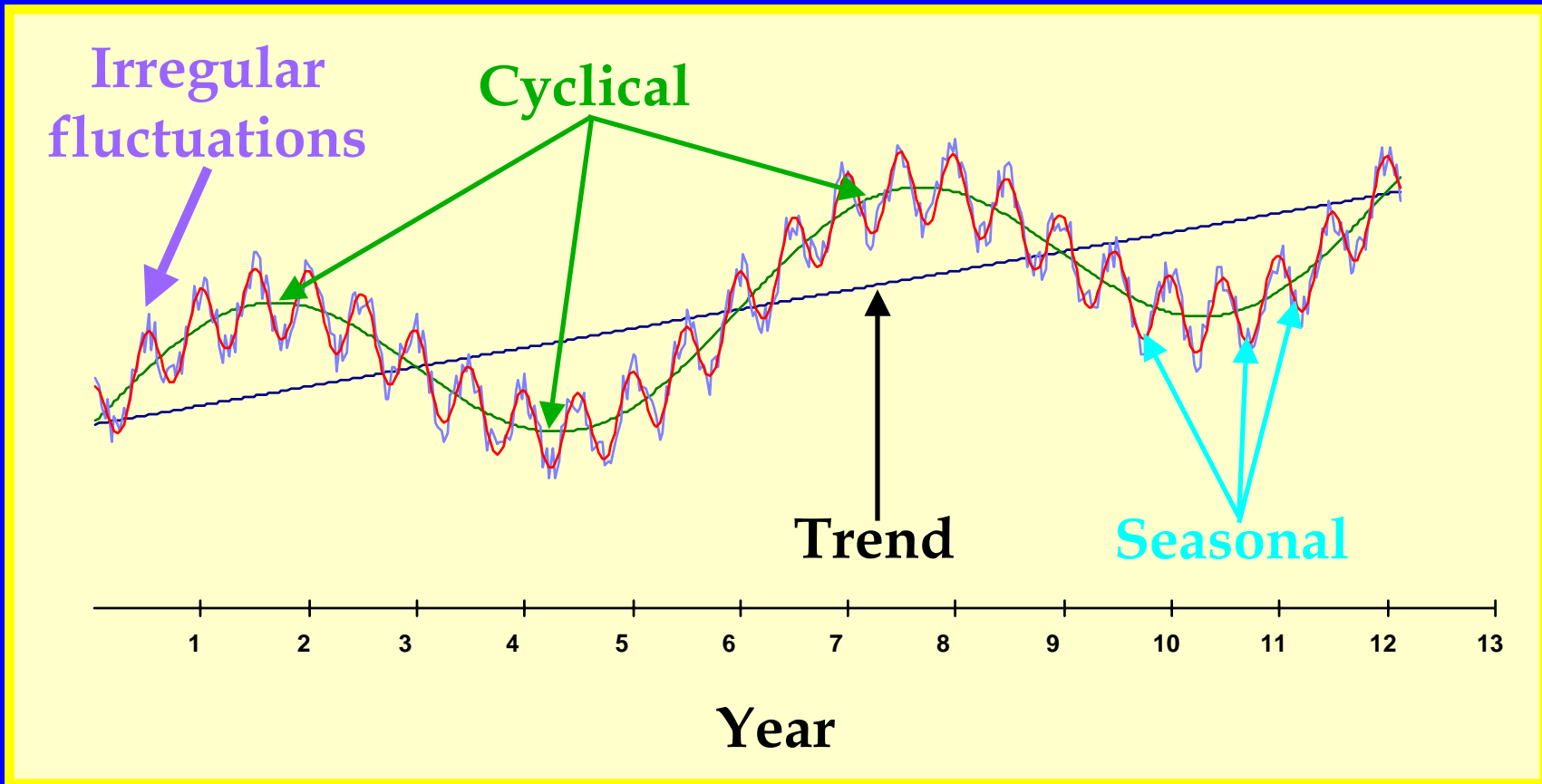of a time series.*

15.2 Components of Time Series

1. **Long-term trend**

2. **Seasonal components**

3. **Irregular cycles**

4. **Random fluctuations**

Time Series Components

- Trend: Long-term upward or downward change in a time series
- Seasonal: Periodic increases or decreases that occur within one year
- Cyclical: Periodic increases or decreases that occur over more than a single year
- Irregular: Changes not attributable to the other three components; non-systematic and unpredictable
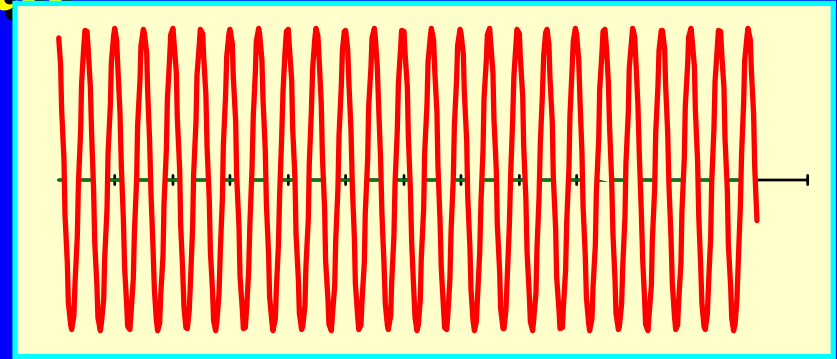
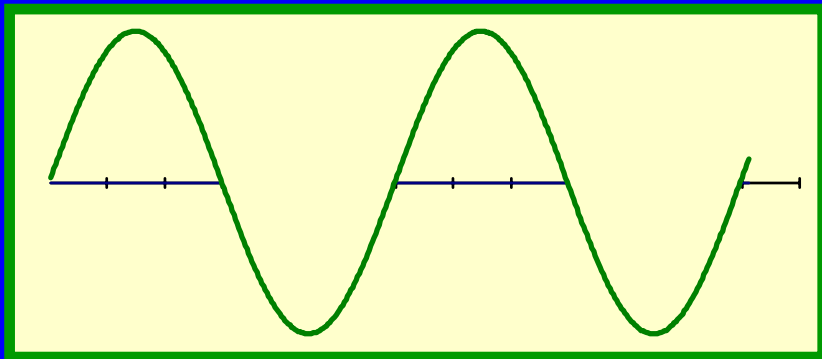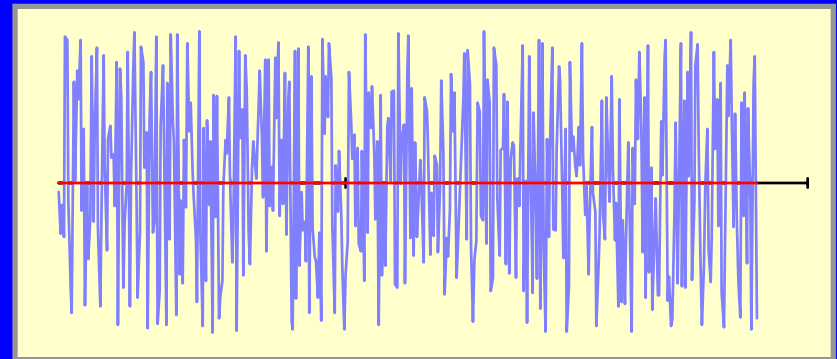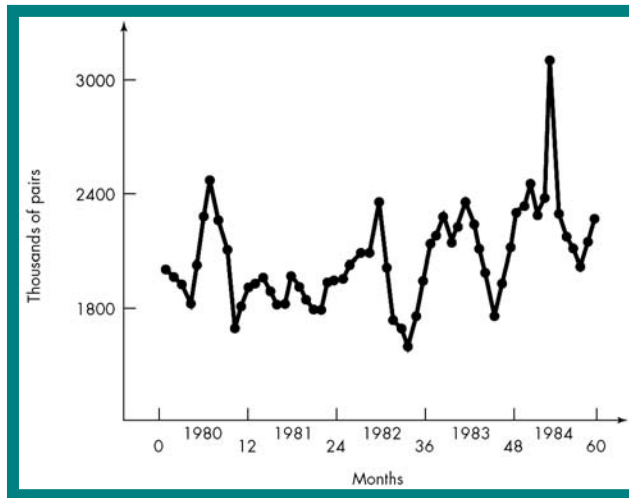# Components of Time Series Data

Components of Time Series Data
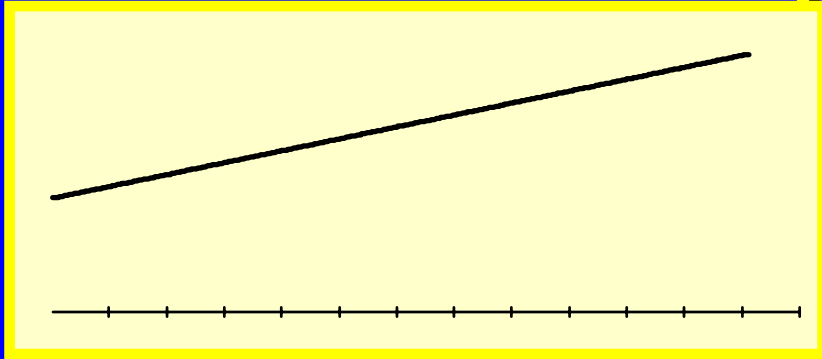
Trend

Seasonal

Cyclical

Irregular

Long-Term Trend

Trend: steady increase or decrease across time.

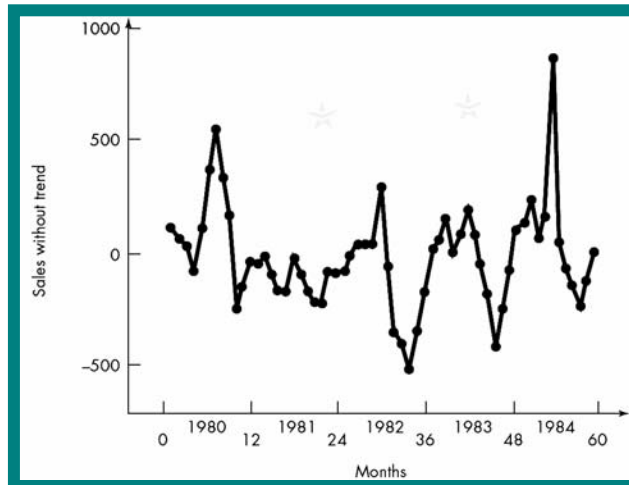**Increasing trend for jean sales**

The **regression line** is:
    sales = 1880 + 6.62 (months)
where month 1 = Jan 1980
Expect sales to increase about 6.62 units (or 6620 pairs) per month.

An example of a
detrended time series:
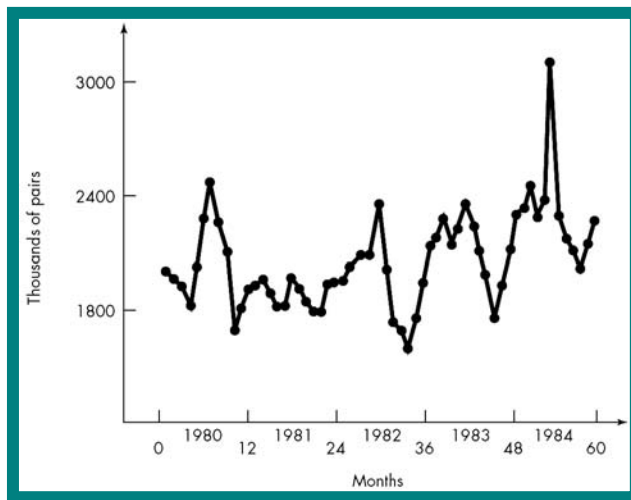Jeans sales with trend removed

Seasonal Components

Seasonal components: tend to be high in certain months or seasons and low in others every year.
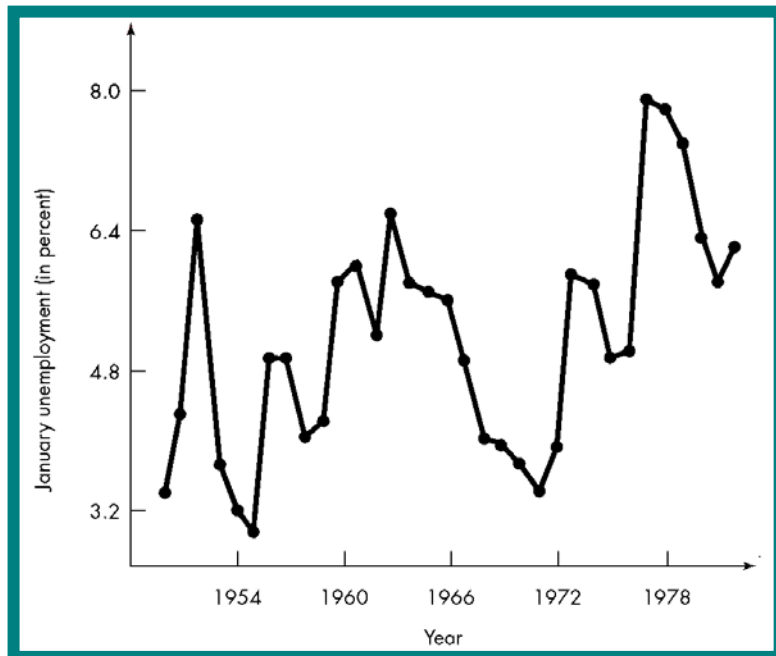

Seasonal component for jean sales

Sales peak during June and July and reach a low in October every year.

Economists have sophisticated methods for seasonally adjusting time series using *seasonal factors* as multipliers.

Irregular Cycles and Random Fluctuations

U.S. unemployment rate, seasonally adjusted for each Jan from 1950-1982.

Irregular cycles – some explained by social and political factors.

Random fluctuations – what is left over when the other three components have been removed. They are part of the natural variability present in all measurements.

15.3 Seasonal Adjustments: Reporting the CPI

Most news reports do not give the actual CPI – only the *change* from the previous month.

Consumer Prices Rose 0.3% in June *Washington, July 13—Consumer prices climbed three-tenths of 1 percent in June, as increases for cars, gasoline, air fares and clothing more than offset moderation in housing, the Labor Department reported today. (Hershey, 19 July 1994, p. C1)*

Also often missing is the statement: "Consumer prices— percent change, month to month, *seasonally adjusted*."

Adjustments have already been made since certain items are expected to cost more during certain months of the year.

Why Are Changes in the CPI Big News?

Financial markets are ***extremely sensitive to changes*** in the rate of inflation.

*Unlike Tuesday's surprisingly favorable report that prices at the producer level were unchanged last month, the **C.P.I. data provided little comfort to the majority of analysts**, who say that inflation—higher in June than in either April or May—has begun a gradual upswing, and that the Federal Reserve will need to raise short-term interest rates again by mid-August. (Hershey, 19 July 1994, p. C1)*

It is the ***changes*** that ***attract concern*** and attention, not the continuation of the status quo.

15.4 Cautions and Checklist

Ask the following when reading time series data:

1. Are the time **periods equally spaced**?
2. Is the series **adjusted for inflation**?
3. Are the values **seasonally adjusted**?
4. Does the series **cover enough of a time span** to represent typical long-term behavior?
5. Is there an **upward or downward trend**?
6. Are there other **seasonal components** that have not been removed? (E.g. sales of toys go up in December.)
7. Are there **smooth cycles**?

Example: The Dow Jones Industrial Average

Dow Jones Industrial Average (DJIA): weighted average of price of 30 major stocks on NYSE.
But DJIA is *not adjusted for inflation*.

In 1970, high was $842.00 (on Dec 29).
In 1993, high was $3794.33 (also on Dec 29).
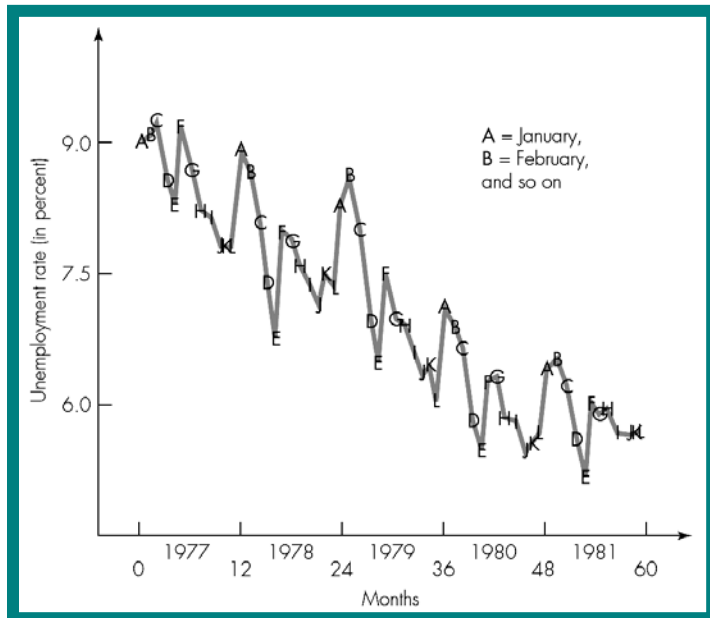CPI in 1970 was 38.8, and in 1993 it was 144.5.
Did DJIA rise faster than inflation?

Value in 1993 = **(value in 1970)×(CPI in 1993)/(CPI in 1970)**
= **($842.00)×(144.5)/(38.8) = $3135.80**

High of $3794.33 cannot be completely explained by inflation.
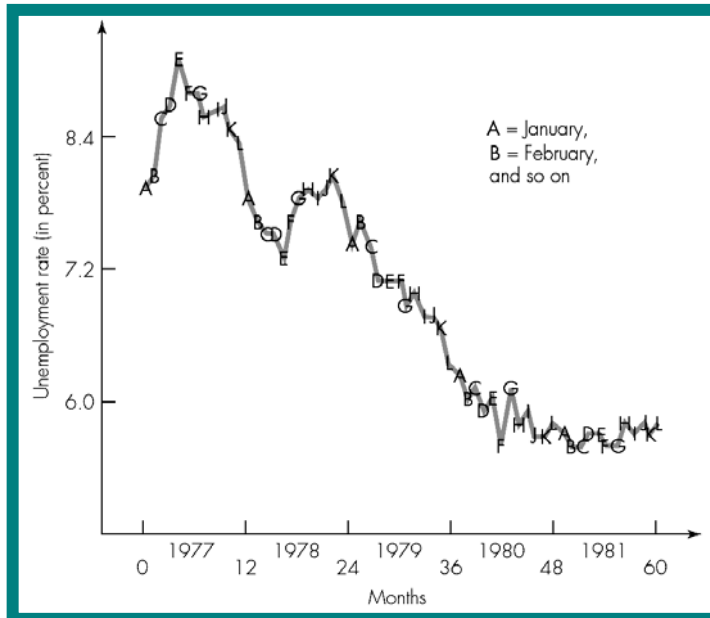Ratio: $3794.33/$3135.80 = 1.21 => increase in DJIA highs
is 21% after adjusting for inflation using the CPI.

Case Study 15.1: If You're Looking for a Job, Try May and October

Unemployment rates for 1977–1981
before *being* ***seasonally adjusted***.

Sharp increases between
Dec (L) and Jan (A) and
between May (E) and June (F)

Unemployment rates for 1977–1981
after *being* ***seasonally adjusted***.

Extremes have been removed.
Series shows much less variability.

Source: Miller, 1988.