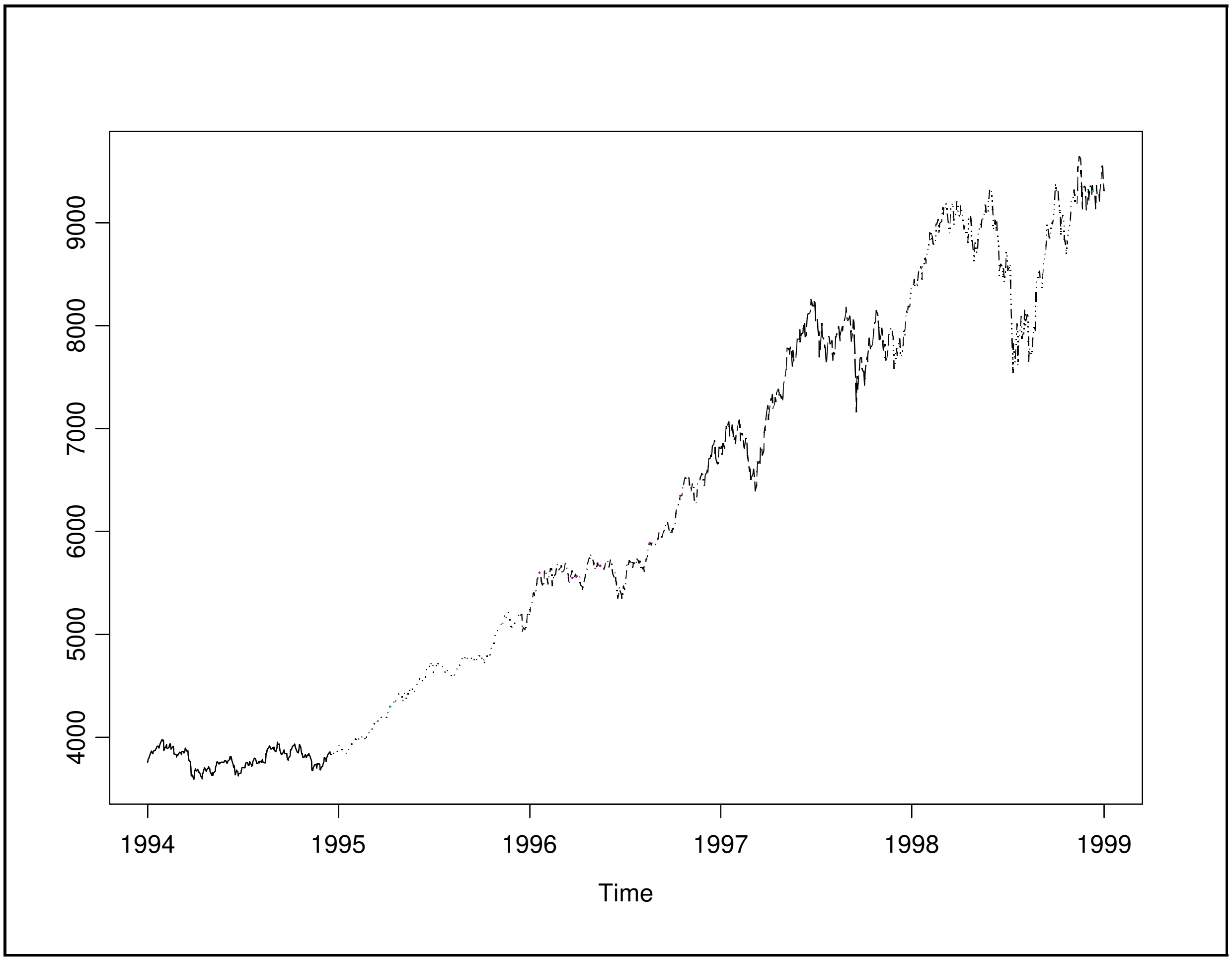
More on Time Series

The Dow Jones Industrial Average, 1994–1999

On the next page I have plotted the daily closing Dow Jones Industrial Average (a measure of value in the stock market), from January 3, 1994 to approximatly Feb 15 1999. (Source: *Journal of Computational Intelligence in Finance*, homepage at `http://ourworld.compuserve.com/homepages/ftpub/jcif.htm`).

Some features are easy to see, others hard to see.

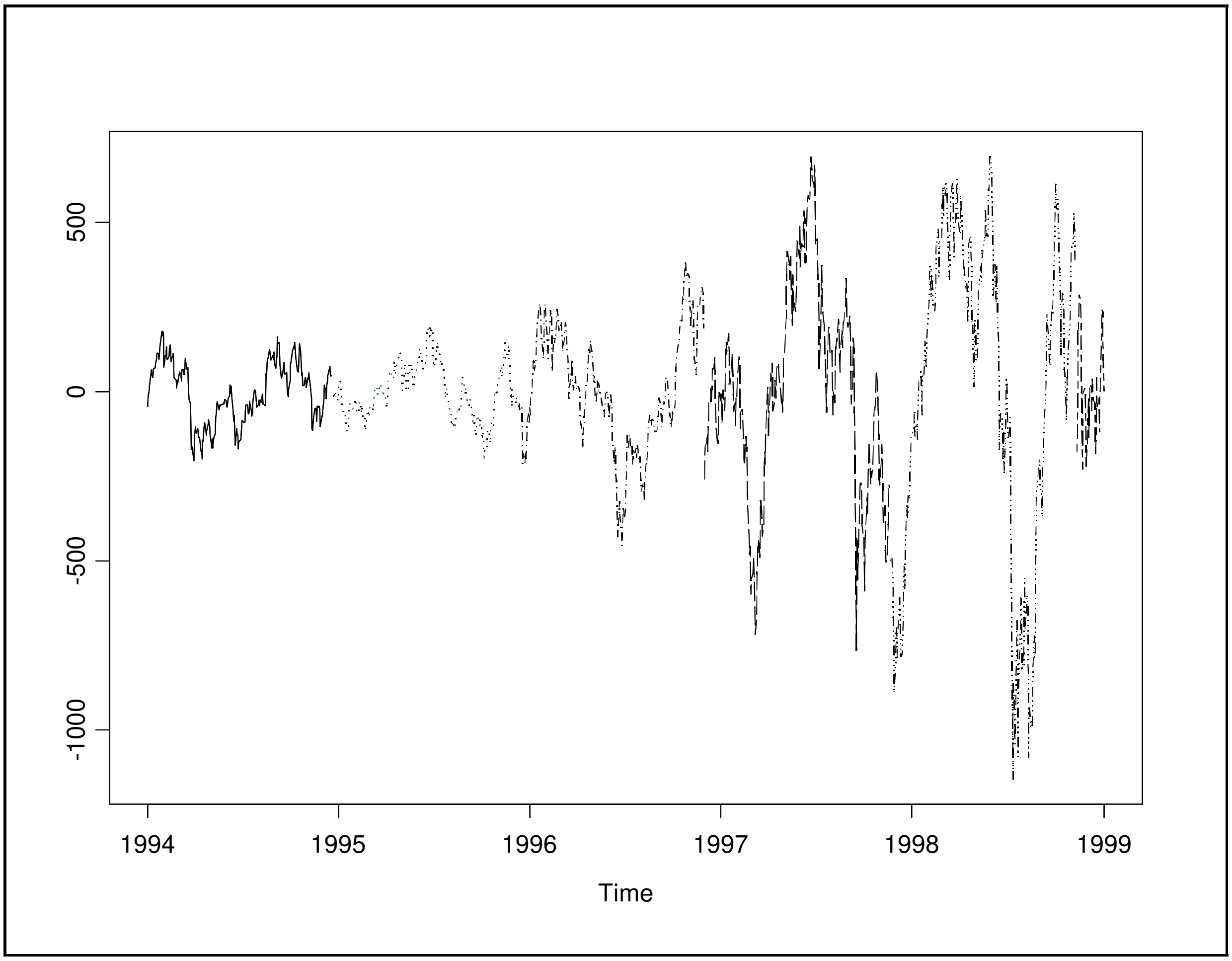


- *Trend:*
- *Seasonal Variation:*
- *Cycles:*
- *Small Scale Fluctuations:* (e.g. reactions to particular national or world events)
- *Changing Variability:* (a.k.a. "*volatility*")

Some features are difficult to discern, so I re-plotted the data after “taking out the trend”:

- I fitted a straight line regression to each year’s worth of data;
- I subtracted the regression line from each data point;
- The resulting differences (the *residuals!*) are plotted on the next page.

In time series parlance, the residuals are called the “de-trended” data.



Now we see:

- *Trend:*
- *Seasonal Variation and other Cycles:*
- *Small Scale Fluctuations:*
- *Changing Variability/Volatility:*

Interrupted Time Series

What is the influence of a specific event on a time series?

- What was the effect of the impeachment hearings?
- What was the effect of the start of NATO bombing of Kosovo?

Need a smaller segment of the time series.

- Small enough so that large changes due to trends or changing variability do not cloud the picture.
- Large enough to establish a pattern of behavior before and after the event.

Sometimes these goals are in conflict!

We will look at the effect of the deteriorating negotiations and subsequent NATO air war in Kosovo, on the stock market.

1999 Kosovo chronology (`http://www.nytimes.com`):

January 1999 45 ethnic Albanians slain by Serb forces in one incident, 24 in another; spurs international efforts for a peace settlement, and demands that warring sides attend peace conference or face NATO airstrikes.

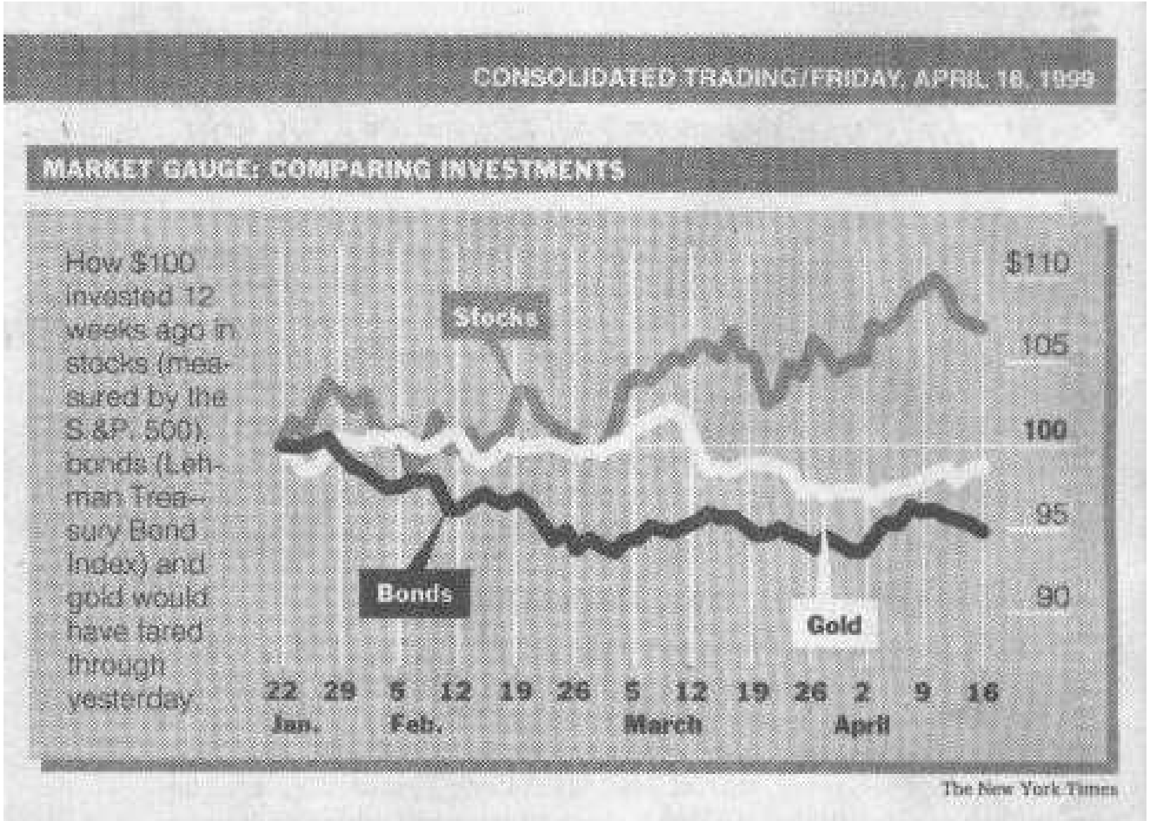
February-March Early Feb. talks at Rambouillet, Fra. Yugoslav forces dig in across from NATO forces gathering for a possible peacekeeping mission, and bombard KLA positions in the north. Rebels launch several attacks on Serbs.

(*)**March 18, 1999** Kosovo Albanians unilaterally sign peace deal calling for a broad interim autonomy and 28,000 NATO troops to implement it. Serb delegation refuses and talks suspended.

March 20, 1999 International peace monitors evacuate Kosovo, as Yugoslav forces buildup and launch offensives against rebels. NATO aircraft and ships ready for possible bombardments.

March 22, 1999 U.S. special envoy Richard Holbrooke visits Belgrade to warn Milosevic of airstrikes unless he signs peace agreement. Milosevic refuses to allow NATO troops in Yugoslavia.

(*)**March 23, 1999** Holbrooke declares the talks have failed. NATO authorizes airstrikes. Yugoslavia declares state of emergency – its first since World War II.



NEW YORK (March 25, 1999 4:34 p.m. EST `http://www.nandotimes.com`*)*

Stock prices rebounded Thursday, boosted by strong earnings reports and growing confidence that NATO airstrikes in Kosovo would not reverberate on Wall Street. At the 4 p.m. close, the Dow Jones industrial average was up 169.55 at 9,836.39, the blue chips' first advance after four days of losses. The Nasdaq composite index, heavily weighted with technology issues, was up 69 points, and the Standard & Poor's 500 index rose 21 points.

Stocks had fallen sharply Tuesday [March 23] amid fears that NATO intervention in Kosovo might escalate tensions through-

out Eastern Europe, said William Sullivan, a market strategist at Morgan Stanley Dean Witter. "But the caution and anxiety that we saw in the equities market on Tuesday began to dissipate yesterday and was removed today," Sullivan said. "We now have NATO involvement, but it does not appear to be extreme, the bombing appears to be contained, there appear to be no U.S. or NATO casualties as of yet. All these things are helping."

Larry Wachtel, market analyst at Prudential Securities, recalled that stocks fell in advance of past military actions in Kuwait and Iraq, only to rise after airstrikes or fighting actually began. In 1991, "the bombs fell in the Persian Gulf and we went up, because we were now dealing with reality," Wachtel said. "I love reality; I can react to it." Relief over the Kosovo action allowed traders to focus on positive earnings news.

"Impact Evaluation of the Public Safety and Recreational Firearms Use Protection Act of 1994", Prepared in March 1997, by the Urban Institute (`http://www.urban.org`).

Title XI of the Violent Crime Control and Law Enforcement Act of 1994 (the Crime Control Act) took effect on September 13, 1994.

- Banned the manufacture, transfer, and possession of designated semiautomatic assault weapons, and "exact copies".
- Banned "large-capacity" magazines: ammunition feeding devices designed to hold more than 10 rounds.
- Exempted grandfathered guns and magazines already manufactured.
- Required a study of the effects of these bans, within 30 months of the bans.

To reduce levels of crimes involving these weapons, the law must increase the scarcity of the banned weapons.

- Scarcity = higher prices on primary markets where licensed dealers create records of sales to legally eligible purchasers,
- Also higher prices in secondary markets that lack such records. Usually legal, private transactions, access to legal, minors, convicted felons, and other ineligible purchasers; higher prices.

Prices in primary markets were analyzed; perhaps too early to analyze secondary markets.

Other factors such as change in number or fraction of crimes involving these types of weapons, were also studied.

We will look at some of the primary market price indices (1994 = 100).

General market findings of the study:

- Primary-market prices of the banned guns and magazines rose by upwards of 50 percent during 1993 and 1994, while the ban was being debated, as gun distributors, dealers, and collectors speculated that the banned weapons would become expensive collectors' items.

- However, production of the banned guns also surged, so that more than an extra year's normal supply of assault weapons and legal substitutes was manufactured during 1994.

- After the ban took effect, primary-market prices of the banned guns and most large-capacity magazines fell to nearly pre-ban levels and remained there at least through mid-1996, reflecting both the oversupply of grandfathered guns and the variety of legal substitutes that emerged around the time of the ban.