Statistics 434: Bullet Points for Day 13

Stationarity and Unit Root Tests

If a time series is not stationary, or cannot be transformed to be stationary — say by taking differences, then we are pretty close to stuck. We've lost our major hold on "learning from the past." This being so, we would surely like to have some tests, or at least reassurances, that the processes that interest us are stationary. We've seen (and will review) that there cannot be any general test, but econometricians have created a slew of specialized test that try to speak more softly to the issue. Specifically, they hope to determine when a putative ARMA(p,q) model may have slipped the surly bounds of stationarity.

- Stationarity

    1. Intuition about stationarity and the "shock wave" representation
    2. Corollary to the "any string" example: it is impossible of to test for stationarity in general.
    3. IID vs Random Walk — First step toward $I(0)$ vs $I(1)$
    4. Statistical Requirements: Stationarity and Ergodicity

- Stationarity in an AR Context

    1. The Dickey-Fuller test and its distribution
    2. Augmented DF Test
    3. The S-plus function unitroot()
    4. Slew of other tests: Phillips-Perron etc.

- Contexts where stationarity matters

    1. Pairs Trading
    2. Interest Rate Spreads
    3. Co-integration (a pointer to the future)

ONE-TRIAL LEARNING AND "BORROWING STRENGTH"

Can one ever get by with *single scrap of data* to predict the future? Suppose a person is late for the first day of work. I know managers who would bet their shoes that such a person will have persistent problems with time integrity.

Setting aside any consideration of fair judgement, let's ask why these experienced managers have this belief. In a sense we only have "one observation" about the person — too few for a statistician.

I'll try to explain why I believe that the solution to this puzzle comes what John Tukey called "borrowing strength," an idea that helps in many statistical situations. There is also a connection to the "bird flu and treasury bonds" story.

QUOTE OF THE DAY

"Oh, I have slipped the surly bounds of earth and danced the skies on laughter-silvered wings." — from *High Flight*, John Gillespie Magee's ode to flying. Much quoted after the Columbia disaster.