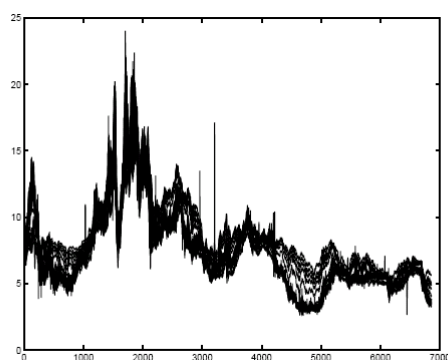


## QuaSSI Backgrounder: Common Trend Models

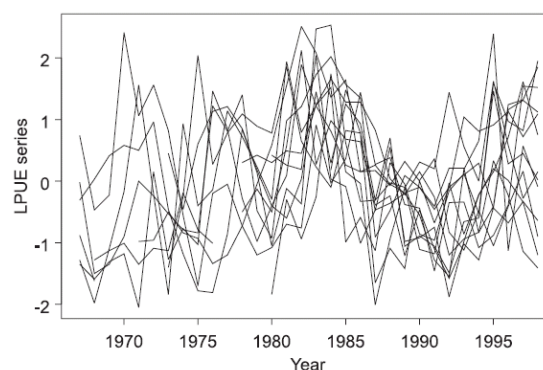
Prepared by Tatiana V. Vashchilko, QuaSSI Predoctoral Fellow

### What are Common Trend Models in Time Series Analysis?

The purpose of common trend models is the estimation of the possible common trend(s) among several groups of time series. These models are applied in the analysis and forecasting of business cycles, interest rates (left figure below), stock prices, ocean temperatures, resource stocks (right figure below), etc.



Daily figures: From January 2, 1974 to October 15 2001.



Typical data: (a) Multiple interest rate time series.

(b) Multiple fishery catch ("landings per unit effort") series

There are three variants: dynamic factor analysis (DFA), time series factor analysis (TSFA), and state space models (SSM).

Dynamic factor analysis (DFA) expands cross-sectional factor analysis in terms of an identification of the sets of distinct variables that describe the underlying pattern of a larger number of measures over time. For example, DFA was used to study temporal variability within individuals (e.g. perceived control of one's environment, emotional positivity and negativity), relationships among life experience variables (e.g. behavioral adaptations to stressful life events, stroke, etc.). Using DFA, Eizenman et al. (1997) found that mortality in older adults correlates with intraindividual variability in perceived control. DFA works only for stationary series. (*Description based on Stern and Carstensen 2000*).

Time series factor analysis (TSFA) allows to study nonstationary times series (under the condition that differenced data satisfies a weak bounded condition). Moreover, in TSFA the dynamic process of the phenomena does not need to be explicitly modeled. That is, TSFA allows to extract the factors, but make almost no assumptions about their dynamics. TSFA was developed to study the effect of macroeconomic phenomena on the monetary side of the economy. TSFA allows one to develop new measures of monetary aggregates that can account for technological innovations in the financial industry, and therefore such measures are more robust than the ones obtained based on other methods. (*Description based on Meijer and Gilbert 2005*).

State space models of common trends (SSM) are the most widely used. SSMs allow working with short as well as non-stationary time series, and can include explanatory variables.

## General Readings

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- J Nyblom, AC Harvey. 2000. "Tests of common stochastic trends." *Econometric Theory*

## Software (\* @ Penn State)

- **STAMP** (Structural Time series Analyser, Modeller and Predictor), developed by economists SJ Koopman, A Harvey, JA Doornik, N Shephard. STAMP is time-series software to analyze models that have such unobserved components as trend, seasonal, cycle, and irregular. <http://stamp-software.com/index.html?content=/whatis.html>
- **SsfPack**, developed by economists SJ Koopman, N Shephard and JA Doornik. This software offers more general procedures than STAMP but with programming features. <http://www.ssfpack.com/>

Many more general software packages provide many tools to estimate, forecast, simulate and analyze time-series data, in some cases with a graphical object-oriented interface:

- **EasyReg**, developed by economist H. Bierens\*. This software has many specific types of time-series tests. <http://www.econ.psu.edu/~hbierens/EASYREG.HTM>
- **R** (<http://www.r-project.org>) **tsfa** package
- **STATA** (<http://www.stata.com/>)
- **EViews** (<http://www.eviews.com/>)
- **RATS (Regression Analysis of Time Series)** (<http://www.estima.com/>)
- **SHAZAM** (<http://shazam.econ.ubc.ca/>)
- **Minitab** (<http://www.minitab.com/>)
- **TSP** (<http://www.tspintl.com/>)
- **STATISTICA** (<http://www.statsoft.com/products/advanced.html>)
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## Applications across Disciplines

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