Final exam "Time Series Analysis".

Summer term 2004 (Fall exam)

Start answering each task on a new page and indicate which task you are working on, e.g. **Task 1 a)** et cetera! The bold face numbers indicate the number of minutes you should plan to work on the respective task and the maximum score you can achieve.

Task 1

Structural VARs (SVAR) allegedly circumvent some of the methodological problems associated with large simultaneous macroeconometric model. Discuss these problems from the time series analysis perspective. **(10 P)**. Why do we not estimate the parameters of the primitive form of a Structural VAR directly? Explain. **(5 P)**. Why do we have to impose restrictions on the contemporaneous effects in an SVAR in order to produce impulse response functions? **(5 P)** What does Granger-causality mean in the context of a bivariate SVAR? **(5 P)**

Task 2

A researcher wants to conduct Dickey-Fuller tests to test four economic time series for (non-)stationarity. Your task is to help interpret the test results.

a) For the first time series, the researcher has estimated a regression model of the form:

$$\Delta Y_t = \gamma Y_{t-1} + u_t$$

The researcher works under the null hypothesis that the true data generating process is given by:

$Y_t = Y_{t-1} + u_t$, where u_t is Gaussian White Noise.

Running the regression the researcher computed the estimate $\hat{\gamma}$=-0.05. The es-

timated OLS standard error $s.e.(\hat{\gamma})$ of the parameter estimate $\hat{\gamma}$ is 0.03. The sample size is 50. Interpret the result. **(5 P)**

b) Using the same time series as in a) the researcher also estimated an alternative regression

$$\Delta Y_t = a + \gamma Y_{t-1} + u_t$$

and maintained the same null hypothesis about the data generating process as before.

Running the regression the researcher has computed the estimate $\hat{\gamma}$=-0.3. The estimated OLS standard error $s.e.(\hat{\gamma})$ of the parameter estimate $\hat{\gamma}$ is 0.03. Interpret the result and provide a reasonable explanation why the two tests may have yielded conflicting results. **(5 P)**

c) The second time series studied by the researcher is depicted in figure 1: What

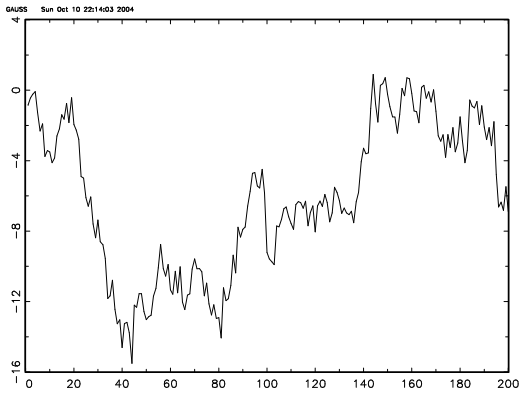

Figure 1: The second time series the researcher is interested in

precise test strategy would you pursue to test for nonstationarity of this series? What would your estimated model and what would the your exact null hypothesis be? Where would you look up the distribution of the test statistic. Defend your strategy! **(5 P)**

d) The $p-$value associated with a Dickey-Fuller τ statistic computed by the researcher to test the third time series for nonstationarity is 0.12 (she has chosen a sensible estimated model and null hypothesis) Interpretation? **(3 P)**

d) The $p-$value associated with a Dickey-Fuller τ statistic computed by the researcher to test the fourth time series for nonstationarity is 0.001 (she has chosen a sensible estimated model and null hypothesis) Interpretation? **(3 P)**

Task 3

In the following, $\{\varepsilon_t\}$ denotes a Gaussian White Noise process. Which of the following processes $\{Y_t\}$ qualify as a unit root (I(1), integrated of order one) process and which of the processes contain an invertible MA part? Give a brief explanatory statement and describe each process as a special case of an ARMA(p,q) process. For example 'This is a stationary AR(2) process.. et cetera' **(18 P)**!

$$(a) \quad (1 - 0.5L - 0.7L^2)Y_t = \varepsilon_t$$

$$(b) \quad (1 - 0.9L - 0.1L^2)Y_t = (1 + 0.3L)\varepsilon_t$$

$$(c) \quad Y_t = (1 - L)\varepsilon_t$$

$$(d) \quad Y_t = (1 + 0.9L^2)\varepsilon_t$$

$$(e) \quad Y_t = c + 0.5Y_{t-1} + 0.3Y_{t-2} + 1.2\varepsilon_{t-1} + \varepsilon_t$$

$$(f) \quad Y_t = \frac{(1 - 1.3L^2)}{1 - 0.8L - 0.1L^2}\varepsilon_t$$

Task 4

Argue in favor of (or against) the following statements. Argue "True, since..." or "Wrong, since..", respectively.

a) The Engle-Granger two step method is applicable to estimate the parameters of a $n-$variables system, in which all series are I(1), and in which up to $n-1$ independent cointegrating relations may exist. **(3 P)**

b) Any finite order MA process is invertible **(3 P)**

c) Using a Dickey-Fuller test, one tests the null-hypothesis that the series is generated by a quite general type of non-stationary process. **(3 P)**

d) The parameters of any stationary AR process can be consistently estimated by OLS. **(3 P)**

d) If you cannot reject the null hypothesis of nonstationarity (using a Dickey-Fuller test) for all economic time series for which you want to set up a multivariate time series model, the best strategy is to model the dynamics of the system in first differences (Structural VAR) **(3 P)**

Task 5

Propose a univariate stochastic process to model the following economic time series. Defend your choice with sensible arguments.

a) A time series of the log of the US consumer price index (quarterly de-seasonalized data). **(4 P)**

b) A time series (daily frequency) of the LIBOR 3 month rate **(4 P)**

c) A time series of log prices of the Deutsche Telekom (Xetra daily close prices). **(4 P)**

d) Squared returns (square of log price change) of the S&P 500 index. **(4 P)**

e) A time series of daily log returns ($\ln(p_t/p_{t-1})$) of daily close Daimler Chrysler stock prices (p_t). **(4 P)**

f) Rate of inflation in the Euro area (monthly, de-seasonalized). **(4 P)**

Task 6

Your task is to analyse leader-follower relationships in the pricing behavior of two oil companies BP and Shell. You have two time series of the BP and the Shell fuel prices (Super Plus, averages of a sample of fuel stations) at daily frequency. Your boss wants a bivariate time series model for the two prices that allows him to assess the dynamics of the price adjustments. Describe the econometric time series model that you would suggest. Describe how you would test the specification and estimate the model parameters. Emphasize the role of testing the time series properties (univariate and multivariate). Explain how you would use your model to analyze leader-follower relations? **(15 P)**