

Problem Set 5
Advanced Macroeconomics II
WISE, Xiamen University

May 22, 2014

The due date for this assignment is Wednesday, May 28, 2014. It needs to be delivered by 2:30 pm before the lecture starts. This problem set gives 15 points in total. Please write your Matlab code in one m file and attach it with your answer to the problem set.

Removing Trends

This assignment asks you to remove trend of two data sets:

1) A selected quarterly U.S. data in file "updated_yeih.txt" available from the course webpage under folder "DataCodes". For detailed explanation of the data, please refer to the "Description of RBC data" on the original data set provided at: http://www.econ.pitt.edu/dbook/Macroeconometric_Analysis_Code.htm, which is to accompany Chapter 3, section 3.1, of the book *Structural Macroeconometrics* by Dave and Dejong, 2007, Princeton University Press.

2) China's per capita GDP index (1978 = 100) in the file "GDP_CN.xlsx" under course folder "DataCodes"

Please follow the instructions step by step. The HP filter function in a Matlab file "HP_filter_fun.m" is attached in the same folder on the teaching page.

1. US data detrending

1) Data download and preparation. Transfer or imported it to matlab.

2) (0.5 point) **Take log of each original data and plot them** in a graph like Figure 3.1 on page 33 of the Dave&Dejong book. Remember to define and display time index properly and add titles to each subplot of your time series.

3) (2.5 points) **Remove a linear trend.** Suppose the original data are generated by the process as specified by equation (3.2) on page 34, the logged data hence have a linear trend g_y as in (3.3). Assume the series output, consumption and investment share a common trend, so that $\alpha_1^j = \alpha_1^j$, $j = 2, \dots, m$. Do a restricted OLS regression to estimate the coefficients α_0^j and α_1^j . Report your result of $\hat{\alpha}_0^j$, $\hat{\alpha}_1^j$ for the three series. (1.5 p) Plot Figure 3.2, where you need to add the estimated trend $\hat{\alpha}_0^j + \hat{\alpha}_1^j t$ for the three series to the original logged data. (1 p)

4) (2 points) **Remove trend by differencing.** Suppose the original data are generated by (3.5) and (3.6), so that the logged data follows (3.8). Assume a common growth rate γ as in assumption (3.11) for the

three non-stationary series, and run a restricted OLS regression for equation (3.9) to get an estimate of $\hat{\gamma}$. Report your estimate. (1 p) Then plot figure similar to Figure 3.2, but now with the trend represented by your estimate: $\log \hat{y}_t = \log y_{t-1} + \hat{\gamma}$. (1 p)

5) (2 points) **Remove trend by H-P filter.** Use the attached function `HP_filter_fun.m` to extract trend. The function has the following input and output structure:

$$[y_hpcycle, y_hptrend] = HP_filter_fun(y, \lambda),$$

i.e. by inputting the data series y and the parameter λ , you get two outputs, the H-P filtered cycle and the H-P filtered trend. Choose $\lambda = 1600$ for quarterly data. Extract trend and cycle for each series including hours. Make a plot like Figure 3.3 on page 37.

6) (3 points) **Comparing detrended consumption by the above three methods.** Plot the cyclical components of consumption, i.e. logged consumption minus the estimated trend from the three methods, in one graph like Figure 3.4 for output. (0.8 p) Plot another graph with the three trends extracted from different methods. (0.7 p) You could choose different colors for each cycle series, but please also choose different patterns of the line so that one can see the difference even from a printed version in black and white. Add legends to each series. (0.6 p) Analysing correlation between these three series and make a table as follows and report your results (those numbers should be precise up to the third digit after zero): (0.9 p)

corr.	Differencing	H-P filtered
Linear	?	?
Differencing		?

2. Detrending China's per capita GDP index

- 1) Data download and preparation. Transfer or imported it to matlab.
- 2) (0.5 point) **Take log of the index and plot it** in a graph with a proper title.
- 3) (1 points) **Remove a linear trend.** Estimate the trend coefficients α_1 and report it. Plot the logged data and the projection from your regression result in one graph.
- 4) (1 points) **Remove trend by differencing.** Suppose the original data are difference stationary with a constant growth rate γ , estimate and report $\hat{\gamma}$. Then plot the logged data and the projection $\log \hat{y}_t = \log y_{t-1} + \hat{\gamma}$ in one graph.
- 5) (1 points) **Remove trend by H-P filter.** Choose $\lambda = 6.25$ for annual data. Extract trend and cycle. Make a plot like Figure 3.3 on page 37.
- 6) (1.5 points) **Comparing detrended GDP index by the above three methods.** Plot the cyclical components of the GDP index from the three methods in one graph. Plot another graph with the three trends extracted from different methods. Analysing correlation between these three cyclical series and report your results with a similar table as with the US consumption data.