Instructions for the analysis of auxiliary material

Data. The main data file is called datafile.xlsx and datafile.csv. The latter data file is imported into Gretl for analysis. The variables in these files are:

Name	Explanation	Units
OPHPBS	Business Sector: Output Per Hour of All Persons	Index
POPCHG	Civilian Noninstitutional Population	Percent change from year ago
CUMFN	Capacity Utilization: Manufacturing (NAICS)	Percent of capacity
HOUST	Housing Starts: Total: New Privately Owned Housing Units Started	Thousands of units started
MORTG	30-Year Conventional Mortgage Rate	Percent

In the Gretl file datafile.gdt you will find the same variables as in datafile.csv and also two more variables, the logarithm of OPHPBS and the seasonal differences of the logarithm of OPHPBS.

Idea and motivation. The HOUST variable is an important indicator of economic activity and is considered to be procyclical and to possibly be a leading indicator for economic growth. It is thus interesting to consider which other factors might be affecting its variability. You are going to build a model that links HOUST with the other variables in the dataset. Comment on whether you agree or not with the choice of explanatory variables, i.e. whether you believe that the other variables are useful in explaining HOUST.

Steps. You do not need to make any variable transformations for this analysis, all variables (except lags) that you may need are given in the Gretl file.

1. So, start off by estimating a static model by regressing HOUST on POPCHG, CUMFN, MORTG and sd_l_OPHPBS. Comment on the sign and significance of the estimated coefficients and give their proper interpretation (remember that such an interpretation should take into account the units with which the variables are measured).
2. Plot the residuals and fitted values from this model. Comment on the appearance of these plots.
3. Compute residual diagnostic tests for autocorrelation, normality and heteroscedasticity and comment on the results that you find. You should find that both heteroscedasticity and autocorrelation is present. What does this imply for your model?

4. Augment your model by making it dynamic, including the first lag of all variables and the first lag of the dependent variable (in addition to the variables that you had before). Re-estimate the model and comment on the sign, significance and interpretation of your results.
5. For the dynamic model you just estimated re-compute steps 2 and 3 and comment on the results of the new tests.
6. You will notice some differences in terms of the significant variables in the static and dynamic models. For example, in the static model the mortgage rate is insignificant while in the dynamic model is significant and the population change is significant in the static model but insignificant in the dynamic model. Why do you think this is happening?
7. In the dynamic model perform three F-tests for multiple zero restrictions on the parameters (based on the individual significance of the coefficients that you estimated in the dynamic model of step 4): the first test is for the population change and its first lag, the second test is for the seasonal difference of log-OPHPBS and its first lag and the third test is for all these four variables together. Use the option Tests…Omit Variables… from the window of the dynamic model to perform these tests. You will do this three times and Gretl will estimate three restricted models. Comment on the test results and based on them confirm that you will select the third restricted model, i.e. the one that does not have population change and the seasonal difference of OPHPBS. We will call this last model the reduced dynamic model.
8. For the dynamic model you selected in the previous step re-compute the residual diagnostic tests of steps 2 and 3. Compare your results on the presence of autocorrelation and heteroscedasticity between the original static model, the original dynamic model and the reduced dynamic model of the previous step. What do you conclude?
9. Perform a CUSUM and CUSUMSQ tests for parameter stability and interpret the visual and printed results of these tests. What do you conclude for the hypothesis of stable parameters in the reduced dynamic model? Be careful to examine the CUMSUM graph and to see where the problem may appear! Link your answer to the plot of the HOUST series and the recent economic crisis!
10. To validate your ideas in the previous step go to the main Gretl menu and change the sample to end in 2005:4, i.e. well before the beginning of the crisis. Re-estimate the reduced dynamic model and comment on the results. Pay particular attention to compare the signs and magnitude of the mortgage and its first lag.