Assignment 4- Must complete using stata and must provide do files, graphs produced in stata and smcl log outputs.

1. Moving average oscillators are often used to determine when to buy and sell (or sell short) securities. They also can be used to help signal trends in the underlying data. Oscillators are calculated by dividing one moving average series by another (note the actual value of the data series is the same as a 1-period moving average). Therefore, a 1/12 quarter oscillator is simply the quarterly value divided by the 12-quarter moving average of the quarterly series. When the 1/12 oscillator crosses above the 1.00 level, the value moves above its own 12-quarter moving average, and that is interpreted as a bullish signal. Conversely, when the value moves below its own 12-quarter moving average, the 1/12 oscillator also crosses below the 1.00 level, and that is taken as a bearish sign. Plotting the data makes it easy to see when the oscillator crosses above and below the 1.00 level (i.e. tsline oscillator, yline(1)). Calculate the 1/12 quarter oscillator using the USCSCOMHPINSA variable in the USCSCOMHPINSA.dta file and answer the following questions (calculate the moving average as a 12-period ***exponential*** moving average).
   1. According to the oscillator are we currently in a bearish or bullish housing market?
   2. In what quarter did the current bearish/bullish market begin?
   3. In what quarter did we hit the bottom of the last bearish market?
   4. In what quarter did the last bull market begin?
   5. In what quarter did the last bull market end?
2. Use all observations in the USCSCOMHPINSA.dta file to perform a Holt-Winters forecast for the next eight quarters and answer the following questions.  
   1. What is the underlying seasonal index for each of the four quarters? *(Round to two decimal places)*

|  |  |
| --- | --- |
| **Quarter** | **Index** |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |

* 1. What are the forecast of the US National Composite Home Price Index and the upper and lower **95% confidence levels** for the next 8 quarters? *(Round to two decimal places)*

|  |  |  |  |
| --- | --- | --- | --- |
| **Quarter** | **Forecast** | **LCL** | **UCL** |
| 2013q1 |  |  |  |
| 2013q2 |  |  |  |
| 2013q3 |  |  |  |
| 2013q4 |  |  |  |
| 2014q1 |  |  |  |
| 2014q2 |  |  |  |
| 2014q3 |  |  |  |
| 2014q4 |  |  |  |

1. What is the mean squared error, mean absolute error, mean percent error, number of forecast outliers and percent of outliers for the in-sample forecast? *(Round to two decimal places)*

|  |  |
| --- | --- |
| **Mean squared error** |  |
| **Mean absolute error** |  |
| **Mean percent error** |  |
| **Number of outliers** |  |
| **Percent outliers** |  |

1. Test the forecast errors using the Skewness/Kurtosis tests for Normality (sktest). Are the errors normally distributed? What are the reported joint adjusted χ2 and p-value of the test?
2. Graph the actual home price index, forecast, lower and upper 95% confidence intervals.  
   *(place graph on next page)*
3. Using the Box-Jenkins Method and all observations in the USCSCOMHPINSA.dta STATA data file, find the best ARIMA class model (without seasonal lags or adjustments) using Schwarz's Bayesian information criteria and forecast the Home Index for the next 8 quarters.
4. What is the best model?
5. What are the forecast of the US National Composite Home Price Index and the upper and lower **95% confidence levels** for the next 8 quarters? *(Round to two decimal places)*

|  |  |  |  |
| --- | --- | --- | --- |
| **Quarter** | **Forecast** | **LCL** | **UCL** |
| 2013q1 |  |  |  |
| 2013q2 |  |  |  |
| 2013q3 |  |  |  |
| 2013q4 |  |  |  |
| 2014q1 |  |  |  |
| 2014q2 |  |  |  |
| 2014q3 |  |  |  |
| 2014q4 |  |  |  |

1. What is the mean squared error, mean absolute error, mean percent error, number of forecast outliers and percent of outliers for the in-sample forecast? *(Round to two decimal places)*

|  |  |
| --- | --- |
| **Mean squared error** |  |
| **Mean absolute error** |  |
| **Mean percent error** |  |
| **Number of outliers** |  |
| **Percent outliers** |  |

1. Test the forecast errors using the Skewness/Kurtosis tests for Normality (sktest). Are the errors normally distributed? What are the reported joint adjusted χ2 and p-value of the test?
2. Graph the actual home price index, forecast, lower and upper 95% confidence intervals.  
   *(place graph on next page)*
3. Using the USCSCOMHPINSA.dta data file, hold-out the last four quarters and produce a Holt-Winters forecast and a forecast using the best ARIMA class model from Question 3 above.   
   1. What are the actual values of the US National Composite Home Price Index for 2012, the Holt-Winters forecast, the Holt-Winters percent error, the ARIMA forecast and the ARIMA percent error? *(Round to two decimal places)*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Quarter** | **Home  Index** | **Holt-Winters Forecast** | **Holt-Winters Error %** | **ARIMA Forecast** | **ARIMA  Error %** |
| 2012q1 |  |  |  |  |  |
| 2012q2 |  |  |  |  |  |
| 2012q3 |  |  |  |  |  |
| 2012q4 |  |  |  |  |  |
| Mean |  |  |  |  |  |

1. Before analyzing the accuracy of the models using the hold-out sample, which model performed better in-sample over the entire period using the results from Questions 2 and 3?
2. Analyze the performance of the models during the hold-out sample. Is their performance different than what you expected before you performed the hold-out analysis? Explain why you think the forecast from the models behaved as they did. Using all of the information available to you which forecast model would you choose?
3. Graph the actual home price index, Holt-Winters and ARIMA forecasts.  
   *(place graph on next page)*