ECON452: Week 8

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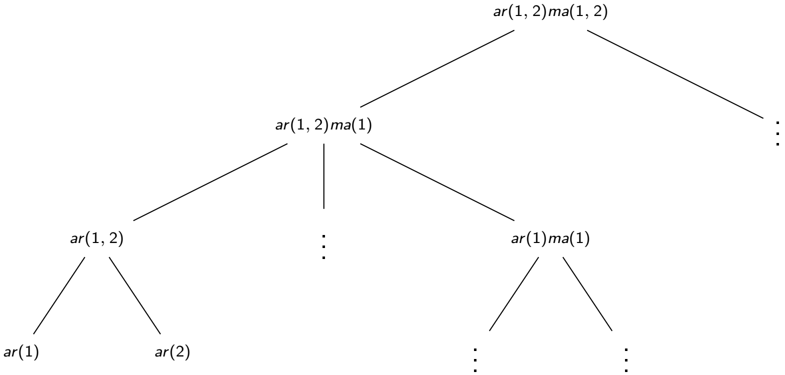
Model Building and Selection Criterion

1. This week, we talk about model selection, forecasts transformations and building nice graphs/tables.
2. Basic idea: by following the Box-Jenkins, methodology it is almost certain you will come up with more than one candidate model. On what basis should a model be selected as the "best" one?
3. Testing thoroughly the data and the model specification leads to more than one candidate model. If you end up with only one, you should think about additional testing procedures.

Testing Your Model Specification

1. The general approach I have given in this class is to start broad (high p, high q) and to reduce the model through statistical tests.
2. This leads to the following question: how should we reduce the model?
3. One could prefer to reduce the moving average side first and then look at the autoregressive part after wards.
4. Another person can do the opposite or another procedure.
5. The first approach can lead to, say, an AR(1) while the second approach might lead to MA(2).

Testing Downward Leads To Many Paths



Testing Your Model Specification

1. Hence, it is important that you check alternate “routes” in your testing procedure.
2. Likelihood Ratio tests are useful in that respect in that they are independent of the path “in between” two models.

Testing Your Model Specification

1. You should also check if your data specification is correct.
   1.1 How would the model be different in a seasonal/non-seasonal approach?
   1.2 If your data is transformed in logarithms or percentages, does the model change?
   1.3 If you filter your data or not?
   1.4 What with missing observations?
   1.5 What if you remove some subsamples with different patterns?

Everything you assume/choose should be tested.

Testing Your Model Specification

1. Such type of extensive testing leads to many model specifications.
2. There are various criterions that help for guidance.
3. They are:
   3.1 Parcimony: small models with small q, p;
   3.2 The smallest forecasting error;
   3.3 PAC/AC graphs dominance;
   3.4 Aïkake/Schwartz criterions;
   3.5 Intuitive meaning.

Testing Your Model Specification

1. The logic behind Aïkake/Schwartz criterions is that religious adherence to a "downward" testing procedure will lead to models that are too large.
2. Hence, they introduce a trade-off between fit and the number of coefficients by adding a penalty to adding "too much" of them.
3. This logic is similar to the adjusted r-square.

$$AIC \equiv 2k - ln(L) \qquad BSC \equiv n \ln(\hat{\sigma}^2) + k \ln(n)$$

Testing Your Model Specification

1. These criterions can be seen when using the command *varsoc* varname in Stata.
2. Stars (*) indicates the optimal number of lags for an AR model.
3. They also report Likelihood-Ratio tests for order selection.
4. However, this command only relies on the autoregressive part. For a correct value based on a candidate model, they must be computed by hand.

Miscellanea: Making Forecasts That Matters

1. In order to reach a stationary process, it is common to differentiate, remove a time trend or to use logarithmic transformations.
2. Hence, forecasts are generally on $\ln(y)$, Δy, $\Delta \ln(y)$ or $y - \beta_0 - \beta_1 t$.
3. But what matters to (most of) us is to forecast on real variables, not on its stationary counterpart!
4. I give examples below on how to do this.

Miscellanea: Making Forecasts That Matters

1. Assume you have the following confidence band for a forecast:

$$\Delta\hat{y}_{t+1} \pm 1.96\text{s.e.}(\Delta y_{t+1})$$

2. Since we know the realized value of y_t, we can treat it as a constant and use it to transform the data:

$$\begin{aligned} \Delta\hat{y}_{t+1} \pm 1.96\text{s.e.}(\Delta y_{t+1}) + y_t \\ \hat{y}_{t+1} - y_t + y_t \pm 1.96\text{s.e.}(\Delta y_{t+1}) \\ \hat{y}_{t+1} \pm 1.96\text{s.e.}(\Delta y_{t+1}) \end{aligned}$$

3. Hence, we have a confidence region for $\hat{y}_{t+1}$.

Miscellanea: Making Forecasts That Matters

1. Assume you have the following confidence band for a forecast:

$$\left[\underbrace{\hat{\ln}(y_{t+1}) - 1.96\text{s.e.}(\ln(y_{t+1}))}_{\equiv l}, \underbrace{\hat{\ln}(y_{t+1}) + 1.96\text{s.e.}(\ln(y_{t+1}))}_{\equiv u}\right]$$

2. Use the transformation $e^{\hat{\ln}(y_{t+1})}$ to get the predicted value of $\hat{y}_{t+1}$.
3. Since $\hat{\ln}(y_{t+1})$ is between $[l, u]$ 95% of the time, we have that $\hat{y}_{t+1}$ is also between $[e^l, e^u]$ 95% of the time.

Miscellanea: Building Nice Tables

1. The command *outreg2* allows to build nice tables in excel/word or even LaTeX.
2. Basic syntax: *outreg2 using "OUTPUT/tablesArima.csv", replace o*
3. The option "replace" is used to erase the last save (if any).
4. The option "append" (instead of replace) adds a new column of estimators in the last file opened.
5. This allows for multiple columns of different models in one table for ease of comparison.
6. The option "o" abbreviates "one column" to put all arima estimates in one single column.

Miscellanea: Building Nice Graphs

1. If you want to build nice graphs with “grey areas” for confidence regions, you can use the following syntax: *graph twoway (rarea upper lower time) (line predicted time)*
2. The first set of parentheses plots a grey area between the variables upper and lower against time.
3. The second set plots the variable predicted against time.

Miscellanea: Building Nice Graphs