ADVANCED TIME SERIES ECONOMETRICS LAB 4

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Revising ATSE lab material

- In terms of revising lab material, I would suggest that:
- You first focus on the examples and interpretation in Gary's slides.
- Then go through the lab examples, ensuring you can adapt and extend Gary's interpretation for each example.
- Don't blindly apply Gary's interpretation to each example.

Revising ATSE lab material

- Think about:
- **Question context** e.g. Which variables are included? What economic question of interest are we trying to address?
- **Key terms** e.g. transition probabilities, principal component eigenvectors
- **Reporting key facts** e.g. magnitude, sign and statistical significance of coefficients, lowest information criteria
- **Economic interpretation** e.g. Are we interested in the magnitude or sign of coefficients? What do these coefficients represent economically? If a certain model has the lowest information criteria what does this demonstrate?

Dynamic factor model: checklist 1

- Estimate the full dynamic factor model. If we have no exogenous variables:

$$f_t = A_1 f_{t-1} + \cdots + A_p f_{t-p} + v_t$$
$$u_t = C_1 u_{t-1} + \cdots + C_q u_{t-q} + \varepsilon_t$$
$$y_t = P f_t + u_t$$

- We have m factor equations with p lags. In the exercise, we have $m = 1$ factor so we only have one factor equation.
- We have n error equations with q lags. In the exercise, we have $n = 4$ variables so we have 4 error equations.
- We have n y_t equations. In the exercise, we have $n = 4$ variables so we have $4y_t$ equations.

Dynamic factor model: checklist 1

- STATA: type "help dfactor" into the command window.
- STATA: dfactor $(ld_i ncome ld_i pld_e mploy ld_S P500 =, \text{ar}(1))(f = \text{ar}(1)) \rightarrow$ 1 lag in the error equation, 1 lag in the factor equation.

Dynamic factor model: checklist 2-4

- **2. Check for persistence in the factor equation:** $f_t = A_1 f_{t-1} + \cdots + A_p f_{t-p} + v_t$
- Are the coefficients in the factor equation significant?
- If the coefficients are significant, what does their size tell us about persistence?
- **3. Check for persistence in the error equation:** $u_t = C_1 u_{t-1} + \cdots + C_q u_{t-q} + \varepsilon_t$
- Are the coefficients in the error equation significant?
- If the coefficients are significant, what does their size tell us about persistence?
- **4. Check the factor loadings:** $y_t = P f_t + u_t$
- Are the coefficients significant?
- If we look at the factor estimates and the size and sign of the coefficients, what does this tell us about how the factor should be interpreted? We can also test whether $\text{var}(u_t) = 0$

Dynamic factor model: checklist 5-6

- **5:** Repeat steps 1 – 4 for the static factor model with VAR errors (part c) and the static factor model (part d).
- **6. Use information criteria and your results to decide which model is best**
- Do we need persistence in the factor equations?
- Do we need persistence in the VAR errors?
- For more help on interpreting DFM output, look at slides 56 – 62. I will discuss part e in the lab since Gary goes through how to examine models individually.

Part E some output

- To compare models, we consider information criteria.
- DFM ($(p = q = 1)$

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	691	.	9926.619	17	-19819.24	-19742.09

- SFM with VAR Errors $(p = 0, q = 1)$

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	691	.	9852.668	16	-19673.34	-19600.73

- SFM $(p = q = 0)$

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	691	.	9707.565	12	-19391.13	-19336.67

Part E some output

- The more we restrict our DFM the higher the information criteria.
- Thus the DFM outperforms the SFM with VAR errors, and SFM.
- This suggests that the data is highly persistent.
- Do we have persistence in the factor equation, error equations or both?

Part E some output

- $p > 0 \rightarrow$ lags in factor equation $\rightarrow$ persistence due to common factors.
- Coeff. associated with f_{t-1} in DFM (output not printed) is 0.8 and is statistically significant indicating persistence.
- $q > 0 \rightarrow$ lags in error equations $\rightarrow$ persistence due to unobservables.
- Coeffs. associated with lagged errors in DFM (output not printed) are statistically significant but small in magnitude (and some are negative).
- Suggests we should next consider $p = 1, q = 0$.