Exam FIN3006 Applied Time Series Econometrics, Spring 2022

Question 1 (15%)

a) Let u_t be the unemployment rate time t. Use the results in equation (1) based on 300 quarterly observations for Norway to test whether the unemployment rate is stationary.

$$(1)\ \Delta u_t = \underset{(3{,}10)}{0{,}95} - \underset{(-5.10)}{0.35}\ u_{t-1} + \underset{(3{,}50)}{0{,}22}\ \Delta u_{t-1}$$

Numbers in parentheses below the estimates are t-statistics.

b) The unemployment rate increased sharply through the corona pandemic. Use the results under a) to discuss possible long-run consequences of this shock to the unemployment rate.

Question 2 (15%)

Comment on the following statement: "If we combine a set of non-stationary variables in a regression model, we always obtain meaningless estimates."

Question 3 (50%)

A researcher has estimated different variants of housing price models. The results are reported in Table 1 where p_t is the log of the housing price time t, y_t is the log of households real disposable income, r_t is the interest rate measured in per cent at time t, u_t is the unemployment rate measured in per cent at time t, $ec1_{t-1} = p_{t-1} - 1{,}50y_{t-1} + 0{,}24r_{t-1} + 0{,}02u_{t-1}$ and $ec2_{t-1} = p_{t-1} - 1{,}50y_{t-1} + 0{,}25r_{t-1}$. The analysis is based on 280 quarterly observations. Table 1 reports estimated parameters with t-statistics in parentheses. Assume that p_t, y_t and r_t are non-stationary variables, integrated of order one whereas u_t is a stationary variable.

a) Why do you think t-statistics are not reported for Model 1 and Model 2?

b) Explain how the results for Model 2 are utilized in Model 5.

c) Use the results for Model 3 and Model 5, respectively, to test whether housing prices cointegrate with income and the interest rate.

d) Find and interpret the short run and long run effects of income, the interest rate and the unemployment rate using the results reported for Model 3, 4 and 5. Also discuss how fast housing prices react to deviations from the long run path.

e) The researcher has also tested whether the error term is autocorrelated. For Model 3, 4 and 5, the null hypothesis of no autocorrelation cannot be rejected. On the other hand, the researcher reports significant positive autocorrelation for Model 6. Explain why this result makes good sense given the estimates for Model 5.

Table 1

Right hand side variables	Model 1 Left hand side variable is p_t	Model 2 Left hand side variable is p_t	Model 3 Left hand side variable is Δp_t	Model 4 Left hand side variable is Δp_t	Model 5 Left hand side variable is Δp_t	Model 6 Left hand side variable is Δp_t
y_t	1,50	1,50				
r_t	-0.24	-0.25				
u_t	-0.02					
p_{t-1}			-0,30 (-8,10)			
y_{t-1}			0,42 (5,50)			
r_{t-1}			0,07 (-3,85)			
u_{t-1}			0,002 (0,40)			
$ec1_{t-1}$				-0,32 (-10,80)		
$ec2_{t-1}$					-0,33 (-11,2)	-0,34 (-10,6)
Δp_{t-1}			0,55 (8,60)	0,52 (9,16)	0,53 (9,18)	
Δy_t			0,63 (6,34)	0,68 (7,10)	0,71 (7,12)	0,75 (7,19)
Δr_t			-0.12 (-5.44)	-0,10 (-4,92)	-0,11 (-5,12)	-0,15 (-5.20)
Δu_t			-0,34 (-4.44)	-0,30 (-4,40)	-0,35 (-5,40)	-0.42 (-5,19)
constant	0,50	0,50	0,18 (3.40)	0,22 (3.50)	0,16 (3,54)	0,18 (3,20)

Question 4 (20%)

Below you find results for two "GARCH in mean" models where y_t is returns to a financial asset, u_t is the residual in the returns equation and σ_t^2 the unconditional variance. Model 2 considers that both expected returns and volatility may be affected by the corona pandemic. This is done by including a dummy variable, corona = 1 for all observations during the pandemic, otherwise = 0. Furthermore, AIC is Akaike's information criterion and log L the log of the likelihood function. The results for the two models are based on 3600 daily observations. Numbers in parentheses below the estimated parameters are t-statistics.

Model 1

$$y_t = \underset{(2.50)}{0.02} + \underset{(3.60)}{0.44}\, y_{t-1} + \underset{(3.50)}{0.12}\, \sigma_t^2$$

$$\sigma_t^2 = \underset{(2.70)}{0.04} + \underset{(3.60)}{0.33}\, u_{t-1}^2 + \underset{(5.66)}{0.66}\, \sigma_{t-1}^2$$

$AIC = 0.35$, $\log L = 152$

Model 2

$$y_t = \underset{(2.60)}{0.025} + \underset{(3.66)}{0.41}\, y_{t-1} + \underset{(3.70)}{0.14}\, \sigma_t^2 - \underset{(-2.30)}{0.005}\, corona_t$$

$$\sigma_t^2 = \underset{(2.77)}{0.04} + \underset{(3.10)}{0.35}\, u_{t-1}^2 + \underset{(4.66)}{0.55}\, \sigma_{t-1}^2 + \underset{(3.60)}{0.02}\, corona_t$$

$AIC = 0.29$, $\log L = 172$

a) Give an interpretation of the results reported for Model 1 and Model 2. Discuss, in particular, whether the results indicate a positive risk premium.

b) How is returns affected by the corona pandemic?

c) Discuss which of the two models you will choose as your preferred one.