

## Exercises Week 1

## 1. Difference Equations (Revision)

1. Consider the AR(1) model (stationary):

$$y_t = \alpha y_{t-1} + \epsilon_t \tag{1}$$

- a) Show that  $E(Y_t) = 0$
- b) Calculate the variance:
- 2. Consider the AR(2) model:

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 y_{t-2} + \epsilon_t \tag{2}$$

- a) Find the equilibrium solution y\*.
- b) Show the characteristic polynomial and describe what are the stability conditions.



## 2. Forecasting

1. Consider the European area economic sentiment indicator (**SENTIMENT**) series in Figure 1. To make some policy decision it was necessary to provide



Figure 1: European area economic sentiment indicator

one-step ahead forecasts for the Sentiment Indicator. To help choose the model to be used in the forecasting exercise the period from 2018:02 to 2020:02 was chosen for evaluation purposes. Two models where considered: i) Model A - a simple AR(4) and Model B - a simple trend model (Sentiment<sub>t</sub> =  $a + bt + e_t$ ).

a) Given the following results, which model would you chose. Justify.

	AR(4)	Trend Model
Mean Error	-9.0148	-39.513
Mean Squared Error	71.134	74.492
Root Mean Squared Error	8.4341	8.6309
Mean Absolute Error	57.733	66.642
Mean Percentage Error	131.16	212.94

b) In addition given the results in Table below indicate in detail how you would compute the Diebold-Mariano test.



Date	Sentiment	Model A	Model B
2018:2	-8.3	68.0	40.3
2018:3	-37.0	-29.6	36.9
2018:4	-62.4	-15.5	32.2
2019:1	-40.0	-46.3	26.4
2019:2	-17.3	-3.0	22.0
2019:3	-86.3	8.1	19.0
2019:4	-13.3	-88.9	12.7
2020:1	-13.5	47.6	10.1
2020:2	129.8	-7.6	7.7

 Table 1: Forecast Results