

EC306 Econometrics II: Time Series

2025 Vacation Assignment

Data: The data file contains U.S. observations on the variables below. The first observation is Jan 1965 in both

Table 1: Data set

Quarterly	Monthly
Real GDP (GDPC1 65)	CPI All Items: Index (CPIAUSCL)
Real Investment sa (RINV)	AAA Investment grade 30 year corp bond rate
The Federal Funds Rate (ffr)	BAA sub-investment grade (riskier) 30 yr corp bond
The 10 year government bond yield (gs10)	FEDFUNDS; federal Funds Rate
The 30-year BAA corporate bond yield (baa)	GS x, x-year government bond rates
	Narrow money stock M1SL
	Producer Price Index PPIACO

quarterly and monthly data sets.

- Examine the real GDP series on the sample 1960q1-2010q4. Discuss the order of integration of the series, considering a plausible alternative hypotheses. Generate a transformation suitable for arma modelling. (10 marks) **Log-transform and then difference it.**
 - Discuss the economic significance of your results, complementing your discussion with any appropriate graphical and/or algebraic analysis. (10 marks)
 - On the sample 1965q1 to 2010q4 estimate
 - an ar(p) **AR(4) best model with AIC -1209.990**
 - arma(p,q) **ARMA(1, 1) or more directly ARIMA (1, 1, 1) is the most suitable as it has the lowest AIC, BIC, HQIC with all significant lags**
- model for your transformation of GDP from part a). Comment briefly on your model selection procedure for choosing the appropriate model in each class, i) and ii). Which is your best model on the basis of in sample fit? (10 marks) **The ARMA(1, 1) with AIC of -1213 is a better and performs better in terms of all Info Criteria**
 - Use the models from part c) to forecast your series at one and four quarters ahead on the sample period 2011q1 to 2019q4. Graph your results and present an appropriate statistic to choose the better model. (10 marks)
 - Estimate a direct step forecasting regression (an ar(p) model) for the four-quarter horizon and compare its performance to those above. How do the results compare to your expectations? (10 marks)
- Do you find any evidence that investment is more strictly rationed when interest rates are more volatile? (20)

Used GARCH(1, 1, 1), to model volatility of rates. Then regresses spread (BAA-AAA) on conditional volatility and found 0.5 significant effect suggesting investment rationing. Additionally volatility granger causes spread.

3. Build a multivariate forecasting model for GDP at the quarterly frequency i.e. a VAR(p) in n variables. Using appropriate samples, compare the forecasts from this model to you forecasts in Question 1 and comment on your results. Do you have any statistical or economic explanations for the patterns you find? (10)
4. Demonstrate a method for incorporating monthly data into your forecast of the transformed output data and comment on the resulting forecast performance. (20)

Generic guidance and notes for non economists:

- Investment is a component of aggregate output of GDP, sometimes thought to ‘lead the cycle’.
- Economic models of investment equate the marginal cost of investment (the price you pay to borrow and invest) with the marginal benefit, i.e. some measure of the marginal product of the capital firms invest in. Rationing investment refers to a market mechanism which ensures only the highest pay-off projects receive funds.
- *sa* stands for Seasonally Adjusted and *cvmsa* is a chained volume measure seasonally adjusted
- You should inspect data by plotting it; it is expected that you make basic transformations to ensure you work with variables suitable for linear models
- Graphs can be included in an answer e.g. if inspection of the graph helps you decide how to make modelling decisions. Unless otherwise stated in the question, graphical analysis alone is not sufficient.
- When you report results of a statistical test, state the test regression, the parameter(s) of interest, the null hypothesis, the test statistic, the value of the test statistic you find, the critical value and the decision you make. Bullet points are fine for such discussion
- Try to summarize the important parts of the regression output in a table, rather than screen-grabbing whole chunks from the raw **stata** output; this makes you think about the output and demonstrates understanding of what is important.