

# EC412: Econometrics of Time Series and Panel Data



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## Course overview and learning outcomes

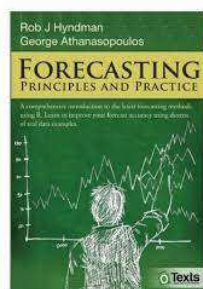
Research in economics, business and finance requires extensive use of sophisticated and refined quantitative skills. In this course you will be introduced to the models and econometric issues that occur when dealing with time series data. Applications of time series methods to economics and finance will be stressed. Students completing this class will be able to decompose time series into its constituent parts, apply the relevant econometric model to data, be able to understand and deal with underlying dynamic macroeconomic models and be able to estimate and interpret univariate and multivariate time series econometric models. Students will also be able to use estimated time series models for policy analysis and forecasting. Students will acquire competence in the tools and methods used in modern econometric research with a focus on theoretical knowledge, critical reasoning, problem solving, interpretation and evaluation. X-12 ARIMA and seasonal adjustment of macroeconomic series will also be learnt.

## Instructional Method

**Structure** – The course has 3 main parts: evaluating patterns using visualization, capturing trend and seasonality to model univariate and multivariate data, and learning each and every step by doing using R and STATA software.

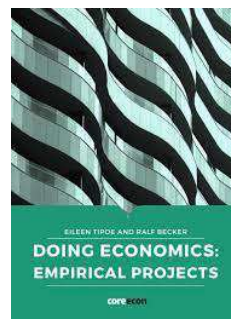
# Books

Main books I will follow are :



Forecasting: Practice and Principles

[Applied  
Econometrics Time  
Series]



Doing Economics: Selected Chapters

# Course contents

Week	Title	Topics covered	Essential reading
1	Introduction to Macroeconomic Series(plotting with Excel and R)	Visualizing and assessing four time series component	Chapter 1 of FPP3 and Doing Economics
		<ul style="list-style-type: none"> <li>• Exploring and visualizing time series</li> <li>• Simple benchmark methods for forecasting</li> </ul>	
2	Exponential Smoothing	<ul style="list-style-type: none"> <li>• Decomposition of Series</li> </ul>	

Week	Title	Topics covered	Essential reading
	Concept of dependence and independence	<ul style="list-style-type: none"> <li>Measuring dependence in a time series: The autocovariance and autocorrelation functions</li> <li>The partial autocorrelation function.</li> <li>Estimation of ACF and PACF.</li> </ul>	
3	ARMA, ARIMA, SARIMA model		
4		Continue	
5	Statistical Forecasting	Advanced forecasting methods Measuring forecast accuracy Checking the best method	

Week	Title	CHOOSING THE BEST METHOD Topics covered	Essential reading
6	Continued	continued	
7	Labs	Labs with Cement Production, M2, CPI and Sales Tax data	Application of all the concepts learnt so far
8			
9	Trends and Nonstationarity	Stochastic vs Deterministic Trends	Ch4. Walter Ender Applied Econometrics
10	Continued	continued	continued
11	VAR, SVAR models	Vector Autoregression	JEP paper VAR and its reproducibility
12	continued	continued	

# Data Science

- You go into data analysis with the tools you know, not the tools you need
- The next 2-3 weeks are all about giving you the tools you need
  - Admittedly, a bit before you know what you need them *for*
- We will extend them as we learn specific models



# R

- **Free** and **open source**
- A very large community
  - Written by statisticians for statistics
  - Most packages are written for R first
- Can handle virtually any data format
- Makes replication easy
- Can integrate into documents (with [R markdown](#))
- R is a *language* so it can do *everything*
  - A good stepping stone to learning other languages like *Python*



# Excel (or Stata) Can't Do This

Code

Output

```
1 ggplot(data = gapminder,  
2       aes(x = gdpPercap,  
3           y = lifeExp,  
4           color = continent))+  
5   geom_point(alpha=0.3)+  
6   geom_smooth(method = "lm")+  
7   scale_x_log10(breaks=c(1000,10000, 100000),  
8                 label=scales::dollar)+  
9   labs(x = "GDP/Capita",  
10        y = "Life Expectancy (Years)")+  
11   facet_wrap(~continent)+  
12   guides(color = F)+  
13   theme_light()
```

## Or This

Input

Output

The average GDP per capita is `` r dollar(mean(gapminder$gdpPercap)) `` with a standard deviation of `` r dollar(sd(gapminder$gdpPercap)) ``.

# Or This

```
1 library(leaflet)
2 leaflet() %>%
3   addTiles() %>%
4   addMarkers(lng = 73.136946, lat = 33.748294 ,
5             popup = "School of Economics, QAU, Islamabad")
```

