



Subject card

Subject name and code	TIME SERIES MODELLING, PG_00070321						
Field of study	Economic Analytics						
Date of commencement of studies	October 2026		Academic year of realisation of subject		2026/2027		
Education level	second-cycle studies		Subject group		Obligatory subject group in the field of study Subject group related to scientific research in the field of study		
Mode of study	Part-time studies		Mode of delivery		at the university		
Year of study	1		Language of instruction		Polish		
Semester of study	1		ECTS credits		4.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Department of Statistics and Econometrics -> Faculty of Management and Economics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Michał Pietrzak				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	18.0	0.0	18.0	0.0	0.0	36
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	36		3.0		61.0	100
Subject objectives	preparing students to apply time series models and panel data models, including their specification, estimation, and critical interpretation, based on knowledge of stochastic processes, econometric modelling of time series and panel data, and selected methods of parameter estimation, in the context of solving economic problems.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_U03] formulates research hypotheses and select appropriate methods for their verification using advanced it tools.		can specify, estimate, and critically interpret time series models and panel data models, applying selected parameter estimation methods and advanced IT tools in the context of solving selected economic problems.		[SU4] Assessment of ability to use methods and tools		
	[K7_W04] has an in-depth understanding of analytical methods, reliable data sources, and copyright principles in the context of solving contemporary socio-economic problems.		knows and understands issues related to stochastic processes, econometric modelling of time series, and panel data modelling methods, in the context of potential economic analyses.		[SW1] Assessment of factual knowledge		

Subject contents	Course content – lecture 1. Classical time series analysis (trend, cyclical fluctuations) 2. Stochastic processes and time series 3. Characteristics of stochastic processes, spectral analysis (concepts of stationarity, autocorrelation, white noise) 4. Autocorrelation function and partial autocorrelation function of a stochastic process 5. Testing the stationarity of a time series 6. Autoregressive processes (AR) 7. Moving average processes (MA) 8. Mixed processes (ARMA) 9. Testing stationarity/non-stationarity of a time series 10. Non-stationary mixed autoregressive-moving average processes (ARIMA) 11. Time series modeling using trend-seasonal-autoregressive models 12. Testing properties of econometric models and forecasting time series 13. Panel data models with fixed effects: identification and estimation 14. Panel data models with random effects: identification and estimation 15. Linear dynamic models for panel data 16. Testing properties of panel models, including tests for fixed effects, random effects, and dynamic models Course content – laboratory 1. Practical identification of trend, seasonality, and autoregression (Classical time series analysis: trend, cyclical fluctuations) 2. Simulation of realizations of stochastic processes (Stochastic processes and time series) 3. Calculation of mean, variance, and autocovariance (Characteristics of stochastic processes) 4. Determination and interpretation of ACF and PACF (Autocorrelation function and partial autocorrelation function of a stochastic process) 5. Stationarity tests (e.g., ADF) and differencing of time series (Testing the stationarity of a time series) 6. Estimation of AR models (Autoregressive processes AR) 7. Estimation of MA models (Moving average processes MA) 8. Selection and estimation of models combining AR and MA and comparison of goodness of fit (Mixed processes ARMA) 9. Stationarity and non-stationarity tests (Testing stationarity/non-stationarity of a time series) 10. Modeling non-stationary data and estimation of ARIMA models (Non-stationary mixed autoregressive-moving average processes ARIMA) 11. Application of trend-seasonal-autoregressive models to describe economic phenomena (Time series modeling using trend-seasonal-autoregressive models) 12. Verification of econometric model properties, residual analysis, and generating short-term and long-term forecasts (Testing properties of econometric models and forecasting time series) 13. Estimation and interpretation of FE models (Panel data models with fixed effects: identification and estimation) 14. Estimation and interpretation of RE models (Panel data models with random effects: identification and estimation) 15. Modeling dynamic relationships with a lagged dependent variable (e.g., GDP growth over time) (Linear dynamic models for panel data) 16. Testing properties of panel models (Testing properties of panel models, analysis of test results for fixed effects, random effects, and dynamic models)														
Prerequisites and co-requisites															
Assessment methods and criteria	<table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>Computational and decision-making tasks (test 1)</td><td>60.0%</td><td>30.0%</td></tr><tr><td>Test with open questions (written exam)</td><td>60.0%</td><td>40.0%</td></tr><tr><td>Computational and decision-making tasks (test 2)</td><td>60.0%</td><td>30.0%</td></tr></table>	Subject passing criteria	Passing threshold	Percentage of the final grade	Computational and decision-making tasks (test 1)	60.0%	30.0%	Test with open questions (written exam)	60.0%	40.0%	Computational and decision-making tasks (test 2)	60.0%	30.0%		
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Computational and decision-making tasks (test 2)	60.0%	30.0%													
Recommended reading	Basic literature	1. Hamilton, J. D. (1994). <i>Time series analysis</i>. Princeton: Princeton University Press. 2. Box, G. E. P., Jenkins, G. M., Reinsel, G. C., & Ljung, G. M. (2015). <i>Time series analysis: Forecasting and control</i> (5th ed.). Hoboken: Wiley. 3. Enders, W. (2014). <i>Applied econometric time series</i> (4th ed.). Hoboken: Wiley. 4. Shumway, R. H., & Stoffer, D. S. (2017). <i>Time series analysis and its applications: With R examples</i> (4th ed.). New York: Springer. 5. Mills, T. C. (2019). <i>Applied time series analysis: A practical guide to modeling and forecasting</i>. London: Academic Press. 6. Pesaran, M. H. (2015). <i>Time series and panel data econometrics</i>. Oxford: Oxford University Press. 7. Baltagi, B. H. (2005). <i>Econometric analysis of panel data</i> (3rd ed.). Chichester: Wiley. 8. Neusser, K. (2016). <i>Time series econometrics</i>. Cham: Springer. 9. Arellano, M. (2003). <i>Panel data econometrics</i>. Oxford: Oxford University Press.													
	Supplementary literature	1. Tsay, R. S. (2010). <i>Analysis of financial time series</i> (3rd ed.). Hoboken: Wiley. 2. Brockwell, P. J., & Davis, R. A. (2016). <i>Introduction to time series and forecasting</i> (3rd ed.). Cham: Springer. 3. Greene, W. H. (2018). <i>Econometric analysis</i> (8th ed.). New York: Pearson. 4. Wooldridge, J. M. (2010). <i>Econometric analysis of cross section and panel data</i> (2nd ed.). Cambridge: MIT Press. 5. Stock, J. H., & Watson, M. W. (2020). <i>Introduction to econometrics</i> (4th ed.). Boston: Pearson													

	eResources addresses	
Example issues/ example questions/ tasks being completed	• What is a stochastic process and a time series? • What do we understand by stationarity of a time series and weak stationarity? • When is an AR(1) process stationary, and what are the consequences of the parameter ϕ lying in intervals (0;1) and (-1;0)? • How to define an AR(p) process, and what is the significance of its coefficients for model stability? • How to define an MA(q) process and interpret the effect of the error term? • State the stationarity condition of an ARMA(p;q) process and the criteria for model order selection. • In which situations do we use the generalized ARIMA model for time series modeling? • How to identify trend, seasonality, and cyclical components in practical time series analysis? • When do we use panel models with fixed effects, and what are their advantages in controlling unobserved unit-specific characteristics? • When do we use panel models with random effects, and how to interpret variability across units? • What are the steps in building linear dynamic models for panel data, including the selection of lagged dependent variables? • How to interpret autocorrelation function (ACF) and partial autocorrelation function (PACF) in identifying temporal structures? • How to test time series stationarity using ADF, KPSS, or PP tests?	
Practical activities within the subject	Not applicable	

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