



Year	2023/2024	
Course title	Financial Engineering	
Course number	222251 - 0998	3 ECTS points
Lecturer	Pruchnicka-Grabias Izabela , PhD	

#### A. Course objective

The aim of the course is to learn students to apply derivatives in risk different investment strategies which is done most of all thanks to teaching their construction and valuation.

#### B. Abstract

Derivatives valuation and their application in risk management, arbitrage and speculation. Valuation of forward and futures contracts, as well as swaps. Options and option strategies and risk associated with them. Methods of hedging short option strategies. Fundamentals of exotic options valuation and possibilities of their application. Valuation of hybrid products. Rules of valuation of weather options and their application, as well as the construction of weather indexes.

#### C. Learning outcomes

Knowledge	<p>Student knows methods of risk reduction with derivatives.</p> <p>Student knows valuation models of all standard derivatives and some non-standard ones. Student is aware of other applications of derivatives than heging, as well as risk associated with them.</p>
Skills	<p>Student can value with analytical methods all standard derivatives and some exotic ones. Student is able to use derivatives in risk management from the individual investor's point of view. Student can construct any hedging strategy for any exporter or importer endangered with currency risk.</p>
Social competencies	<p>Student can identify basic kinds of risk on the financial market and prepare a suitable risk management strategy.</p> <p>Student can conduct an arbitrage strategy on an organized exchange market and knows rules of model's risk existing in this case.</p> <p>Student is able to design a speculation strategy, as well as identify risks which appear here.</p>

#### D. Main issues

- 1 Genesis and application of financial engineering. Causes of crashes on financial markets. Hedge funds activity. Standard and advanced derivatives and problems associated with their applications. Symmetric and asymmetric instruments. The influence of symmetry on its valuation. Volatility and its role in derivatives valuation. Criteria of differentiation among speculation, arbitrage and other investment strategies.
- 2 Speculation on the yield curve in the Polish conditions with the use of forward contracts. Forward rates and their role in interest rates prediction and speculation strategy designing. CFD contracts ? functioning and applications. Kinds of speculation.
- 3 Problems of short option positions applied by banks on the Polish financial market. Currency, commodity and interest rate arbitrage. Differences between speculation, arbitrage and hedging. Kinds of arbitrage. Arbitrage with the use of futures contracts on the WIG20 index from the Warsaw Stock Exchange. The role of the short sale in this process.
- 4 Investment strategies applied by hedge funds. Convertible arbitrage. Dedicated short bias. Emerging markets. Long/short equity. Equity market neutral. Fixed income arbitrage. Event driven. Global macro. Managed futures. Multi-strategy.
- 5 Standard and exotic swaps (second generation). Swaptions. Comparison of different methods of swap valuation. The valuation of swap as a long and short position in a bond. Swap valuation as a portfolio of two forwards.
- 6 Analysis of sensitivity of standard and exotic options ? similarities and differences. Factors influencing prices of various kinds of exotic options. Delta. Gamma. Theta. Vega. Rho. Parameters monitoring and the role of delta in hedging positions.
- 7 Valuation of standard and exotic options contracts with analytical models. Valuation and definition of option warrants. B-S model, Merton model, Black model, Garman-Kohlhagen model and their modifications for exotic options. Models interpretation. Assumptions.
- 8 Valuation of options with binomial trees. Assumptions for the binomial trees method and their adequacy. Idea and application of the hedge ratio. The value of one, two and three period options.
- 9 Valuation of standard and exotic options, complex financial instruments with embedded options and option strategies with simulation methods. Assumptions construction. Problems arising during the valuation of different kinds of exotic options and products having them embedded. Options with stocks. Spreads (bull, bear, butterfly, calendar). Straddle, strangle, strip, strap.
- 10 Chosen variants of exotic options and methods of their construction and valuation. Time-dependent options. Compound. Binary. Forward-start. Chooser. Asian. Barrier. Lookback. Exotic options on the Polish financial market.
- 11 Financial structured products. OTC and stock exchange turnover. Structured forward with barrier options with the possibility of double notional value. Accumulators. Leveraged accumulators. Basket notes. Asian basket notes. Factor certificates with leverage. Convertible certificates with down barrier. Structured certificates with the protection of capital. Investment certificates. Express certificates. Trackers. Bonus certificates. Structures with exotic options.
- 12 Complex financial instruments valuation and construction. Bond with option (exchangeable, convertible). Bonds with a warrant. Bonds with the buy back option. Bonds with a forward contract.
- 13 Weather derivatives. Genesis. Applications and problems concerned with it. Most famous constructions. Problems with valuation. Weather indexes.
- 14 The analysis of payoff functions for exotic options and financial structured products and their changes while additional conditions are introduced. The role of the payoff function in designing hedging, arbitrage and speculation strategies.

- 15 Other kinds of exotic options (ladder, ratchet, hybrid, exchange, rainbow, quotient, AON, CON, basket, best-worst, correlation binary, with double strike, alternative, gap, with conditional premium, with non-linear payoff). Cap, floor, collar.

#### E. Basic literature

I. Pruchnicka-Grabias, Egzotyczne opcje finansowe. Systematyka, wycena, strategie, Wydawnictwa fachowe CeDeWu, Warszawa 2021; I. Pruchnicka-Grabias, Corporate financial risk management, Szkoła Główna Handlowa w Warszawie, Warszawa 2015; I. Pruchnicka-Grabias, Zero-cost collars in currency risk management. Empirical research from the Polish financial market, w: D. Barkovic (red.) et al., Interdisciplinary Management Research XII, The J.J. Strossmayer University of Osijek oraz Hochschule Pforzheim University, Opatija 2016, s. 592 ? 604; ISSN 1847-0408; I. Pruchnicka-Grabias, Traditional versus alternative risk measures in hedge fund investment efficiency, w:

#### F. Supplementary literature

Damodaran A. , Investment valuation, Tools and Techniques for Determining the Value of Any Asset, Wiley, Hoboken 2012. Johnson R. , Derivatives markets and analysis, WILEY, 2017. Pruchnicka-Grabias I. , Hedge funds as retirement investments, w: I. Barkovic Bojanic, A. Erceg (ed.), Strategic approach to aging population. Experiences and challenges, Josip Juraj Strossmayer University in Osijek, Faculty of Economics in Osijek, Osijek 2021, s. 199 ? 211

#### G. Author's most important publications concerning the offered course

Izabela Pruchnicka-Grabias, The Relationship between Gold and Brent Crude Oil Prices: An Unrestricted Vector Autoregression Approach, W: International Journal of Energy Economics and Policy,2021; Izabela Pruchnicka-Grabias, Analiza stóp zwrotu z funduszy hedgingowych za pomocą miar efektywności opartych na dolnych momentach cząstkowych , W: PRACE NAUKOWE UNIWERSYTETU EKONOMICZNEGO WE WROCŁAWIU,2018; Izabela Pruchnicka-Grabias, Equity Portfolio Optimization With Gold , W: Problemy Zarządzania-Management Issues,2020

#### H. Numbers of required prerequisites

not required

#### I. Course size and mode

	Full-time	Saturday-Sunday	Afternoon
<b>Total:</b>	30	21	-
Lecture	30	14	-
Self-study under the supervision of lecturer	-	7	-

#### J. Final mark (assessment)

traditional examination (3 zadania lub 5 case studies)	90%
studia przypadków (Aktywność podczas zajęć)	10%

#### K. Foreign language requirements

English

#### L. Selection criteria

#### M. Methods applied

case studies  
participation of practitioners  
others(STATA)