Blockchain and Cryptocurrencies

Professors: Dr. Gabriel Rodríguez Garnica and Dr. David Tercero Lucas
Office hours: By Appointment
Course Type: Elective
Credits: 4 ECTS
Term: Second Term

Course description

Blockchain is a disruptive foundation technology that enables complex use cases where a single source of truth is needed. Blockchain and Distributed Ledger Technologies are fundamental in the development of cryptocurrencies, tokenised trading solutions and in enterprise blockchain solutions. These solutions will be core components of the next evolution of financial market infrastructure that will reshape financial markets and transform economies.

Enterprise blockchain solutions can transform business relationships through increased trust, allow for the reinvention of products and business processes, and dramatically reduces operating costs and deliver new business value. Enterprise blockchain solutions are still in the early stages of development but the emerging use cases are already demonstrating significant value, and the collaboration within the blockchain community generating rapid progress in both the open source and commercial software communities.

This course will examine the fundamental technologies that make up blockchain solutions, review dominate blockchain platforms, and will examine how these technologies are being used to deliver real business value. Students will examine the importance of blockchain, non-stable cryptocurrencies, stablecoins and Central Bank Digital Currencies, apart from analysing the relevance of DeFi, NFTs and Initial Coin Offerings.

Objectives

This course demonstrates the development of a new system of data storage that will dramatically impact not only financial services and the underlying infrastructure of financial markets, but other non-financial markets. The course will examine the fundamentals of blockchain enabled assets and discuss how to develop enterprise blockchain solutions. The course will also allow students to have a perfect understanding of the whole crypto market, including not only non-stable cryptocurrencies such as Bitcoin but also utility tokens, initial coin offerings, stablecoins, and Central Bank Digital Currencies (CBDCs). The course will help the student to understand how blockchain solutions are integrated into existing and new enterprise services as well as in new markets.

Methodology

This class will use mixture of lectures (in person), tutorials and demonstrations to explain the fundamental concepts of blockchain solutions and cryptocurrencies. The course material will provide a wider context.

Evaluation Criteria

Students will primarily be evaluated in their ability to understand the material covered in class, analysing specific white papers of some cryptocurrencies and presenting some case studies.

Students will be assessed in four ways:

- Participation, short assignments, and attendance (30%). Some of the activities might include: Summary of white papers, short assignments (individual) or quick tests in class after a lesson.
- Group Case study I (25%). The group case might include: Academic Paper presentation and review, Business idea of blockchain uses in the market, or Blockchain analytics (in groups).
- Group Case study II (25%). The group case might include: Report and presentation (in groups).
- Final exam (20%). To be designed.

Students are required to attend 80% of classes. Failing to do so without justified reason will imply a zero grade in the participation/attendance evaluation item and may lead to suspension from the program. Any student that fails to submit any of the assessment items will receive a failing grade. Late submissions of any assessment items will also attract a late penalty to the awarded grade.

Students who fail the course during the regular evaluation are allowed ONE re-take of the evaluation, in the conditions specified above. If the course is again failed after the retake, the student will have to register again for the course the following year.

In case of a justified no-show to an exam, the student must inform the corresponding faculty member and the director(s) of the program so that they study the possibility of rescheduling the exam (one possibility being during the "Retake" period). In the meantime, the student will get an "incomplete", which will be replaced by the actual grade after the final exam is taken. The "incomplete" will not be reflected on the student's Academic Transcript.

Plagiarism is to use another's work and to present it as one's own without acknowledging the sources in the correct way. All essays, reports or projects handed in by a student must be original work completed by the student. By enrolling at any UPF BSM Master of Science and signing the "Honor Code," students acknowledge that they understand the schools' policy on plagiarism and certify that all course assignments will be their own work, except where indicated by correct referencing. Failing to do so may result in automatic expulsion from the program."

Contents

Topic 1. A primer on Blockchain and Cryptocurrencies

a. Understanding DLT
b. Blockchain
c. Consensus mechanisms
d. Forks and disputes
e. Smart contracts and Code-as-Law
f. Security Threats (Attacks)
g. Cold vs Hot wallets
h. Types of Cryptoassets
i. Block explorers: Navigating the blockchain

Topic 2. Early Cryptocurrencies: Bitcoin and Ethereum

a. History and functions of Money.
b. Evolution of Cryptocurrencies: From the first Bitcoin "gold" rush to a long crypto winter.
c. The survival of cryptocurrencies.
d. Bitcoin
    i. Satoshi Nakamoto whitepaper. Original purpose and main features.
    ii. Bitcoin dominance and impact on the crypto market.
    iii. Drawbacks
e. Ethereum, more than a cryptocurrency
    i. Ether: features and monetary policy.
    ii. Smart contracts from Ethereum, possibilities, more than a coin, more than Bitcoin: the TOOL needed!
f. Other major (old) altcoins: LTC, XRP, BNB
g. Ethereum killers: ADA, SOL, DOT, AVAX
h. Meme coins (Dogecoin).

Topic 3. Blockchain Use Cases: Tokenization, enterprise applications and financing.

a. The cryptoasset ecosystem
b. Smart contracts
c. Orables: Connecting the real world
d. Blockchain Solution Strategy Example
e. Blockchain Solution Strategy Development Overview
f. Navigating the Blockchain: Use of block explorers

Topic 4. Stablecoins.

a. Definition and use cases. The importance of stablecoins in DeFi.
b. Capitalization and magnitude of stablecoins.
c. Types of stablecoins:
    i. Off-chain collateralized stablecoins.
    ii. On-chain collateralized stablecoins.
    iii. Algorithmic stablecoins.
d. Are they really stable? A forensic analysis of stablecoins. Terra crash.
e. Tether and the mystery of its reserves.
f. USDC and other relevant stablecoins.
g. Dollar dominance and the irrelevance of Euro-based stablecoins.

h. Regulatory issues. MiCA.
i. Fintech and stablecoins: From Facebook to PayPal.

Topic 5. Beyond Crypto: Tokenization, NFTs, ICOs, STOs, Dapps

a. Tokenization: Bridging Real-World Assets and Blockchain Technology
b. Main industries to tokenize
c. Tokenization regulation
d. Types of tokenized assets
e. Special case of tokenized assets: NFTs
f. Fundraising token opportunities: From crowdfunding to ICOs, STOs, IDOs.

Topic 6. Central Bank Digital Currencies.

a. Origins, definition and the money flower.
b. CBDC design and possible features.
c. Benefits, risks and concerns:
    i. Financial stability considerations.
    ii. Monetary policy considerations.
    iii. Financial inclusion and payments efficiency.
    iv. Privacy and technological considerations. Risks mitigation.
d. CBDC projects:
    i. Live CBDC projects: Bahamas, ECCB, Nigeria and Jamaica.
    ii. Advanced pilots: E-Yuan, digital Rupee, digital real.
    iii. Other projects in Europe: Digital pound and e-Krona.
    iv. What is the USA doing?
e. Digital Euro:
    i. Key objectives and functions of a possible digital euro.
    ii. Stakeholders.
    iii. Phases of the digital euro project
f. Conclusion: Are CBDCs doomed to fail?

Topic 7: Global Cryptoasset Market Analysis and Trends

a. Investment and trading. Factors Influencing Global Crypto-asset Market Trends
b. Types of investors
c. Sentiment Analysis
d. CEx and Dex
e. Academic paper and Blockchain Use Cases presentations

Topic 8. Further topics in digital currencies.

a. Crypto investors in an international context.
b. The importance of social media in crypto.
c. Crypto crises: From Terra-Luna to FTX.
d. CBDC debate and presentation.

Calendar

Session	Prof.	Content	Time
1	GRG	A primer on Blockchain and Cryptocurrencies	4h
2	DTC	Early Cryptocurrencies: Bitcoin and Ethereum	4h
3	GRG	Blockchain Use Cases	4h
4	DTC	Stablecoins	4h
5	GRG	Beyond Crypto	4h
6	DTC	Central Bank Digital Currencies	4h
7	GRG	Global Cryptoasset Market Analysis and Trends	3h
8	DTC	Further topics in digital currencies	3h

Bio of Professors

Gabriel Rodríguez Garnica is an Assistant Professor of Finance at Universidad Pontificia Comillas, ICADE Business School, Madrid. He earned his Ph.D. in Business and Finance from the University Carlos III Madrid (UC3M), received a FPU scholarship, and held a visiting position at Boston University, Questrom School of Business (BU). Professor Rodríguez Garnica's research interests focus on entrepreneurial finance and behavioral finance in the fields of alternative finance and FinTech markets, with a particular focus on crowdfunding, initial coin offerings, tokenization, and blockchain-enabled assets. He has taught various finance-related courses, including Financial Economics, Blockchain and Cryptocurrencies, FinTech, and Digital Finance, at the undergraduate, graduate and executive master's levels. He has also contributed to the book "The Emerald Handbook on Cryptoassets – Investment opportunities and challenges" aimed at academics and practitioners, as well as top academic journals such as Small Business Economics, or Journal of International Money and Finance. His recent work has also received the best paper award on the Cryptocurrency Research Conference 2024 at Dubai.

David Tercero Lucas holds a Ph.D. in Applied Economics from the Autonomous University of Barcelona. He is an Assistant Professor in the Department of Economics at Comillas Pontifical University – ICADE. Previously, he worked as an expert in payments and digital currencies at a Berlin-based consultancy company. During his doctoral studies, he conducted research stays at CREST (Center for Research in Economics and Statistics) in Paris, at Pablo de Olavide University in Seville, and at the International Policy Division of the European Central Bank (ECB) in Frankfurt. Additionally, he served as a technical advisor at the Bank for International Settlements (BIS). His research interests are in the fields of digital currencies (cryptocurrencies, stablecoins and CBDCs), payment systems, monetary economics and applied microeconomics. His academic work has been referenced in the Financial Times and The Economist, cited in working papers by the IMF, World Bank, Bank of Canada, and BIS, and published in international peer-reviewed research journals such as the Journal of Financial Stability and the European Journal of Political Economy. Prior to his Ph.D., he completed a Master's in International Economics at the Autonomous University of Madrid and a Master's in International Economic Policy at the Kiel Institute for the World Economy.