

September 25, 2018 – November 6, 2018
Room KMEC 4-120

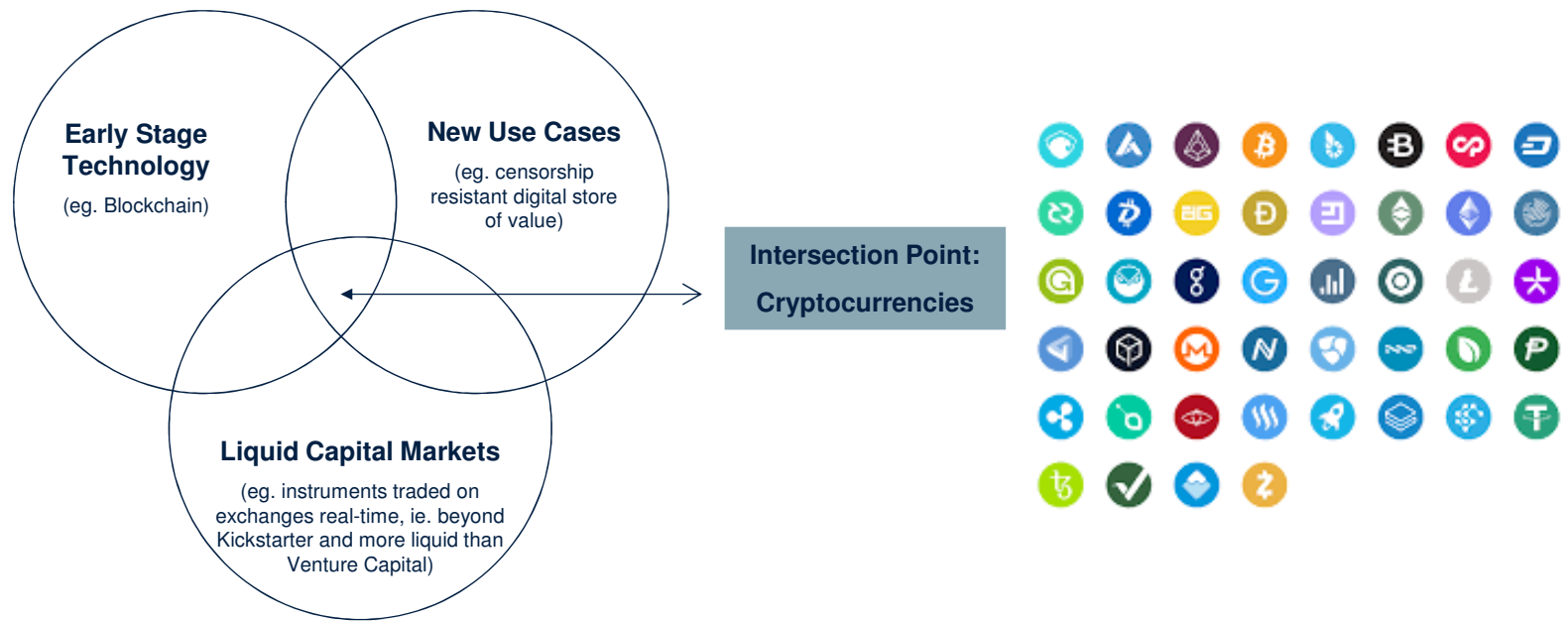
■ Topics In Cryptocurrency Investing (GB.3180) Syllabus and Class-by-Class Outline

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Cryptocurrency Investing (GB.3180)

Introduction

- A cryptocurrency “refers to a math-based, decentralized convertible virtual currency that is protected by cryptography – ie. it incorporates principles of cryptography to implement a distributed, decentralised, secure information economy” (Virtual Currencies Key Definitions and Potential AML/CFT Risks”, FATF Report June 2014)
- The oldest and largest cryptocurrency, in market capitalization terms, is Bitcoin (as of Dec 2017)
- For this course, a cryptocurrency is an emerging asset class representing the intersection of disruptive early stage technology, liquid capital markets and new use cases and business models
- This class focuses on understanding the investment implications of the cryptocurrencies being created at this intersection point

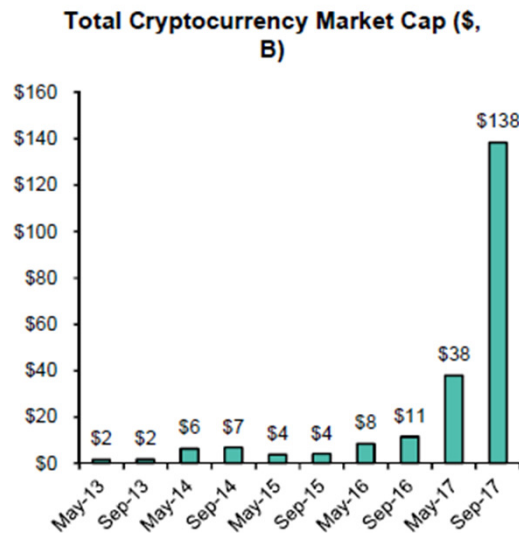


Cryptocurrency Investing (GB.3180)

Context

- *There is significant interest in cryptocurrencies because of their massive rise in market capitalization terms (over 10x from 2016 to 2017)*
- *This rise has caused significant media coverage and prominent executives from finance and technology (fintech) have provided perspectives on cryptocurrency's role and value to society*

The total cryptocurrency market cap has risen >10x in the last year



Source: Coinmarketcap, Coindesk and Bernstein analysis

- ***“The currency [bitcoin] isn’t going to work. You can’t have a business where people can invest a currency out of thin air and think that people who are buying it are really smart. Its worse than tulip bulbs. It won’t end well.....It’s a fraud”*** (Jamie Dimon, CEO of JP Morgan)
- ***“There is no CEO of bitcoin, no headquarters of bitcoin, no owner of the Bitcoin network, just like there is no CEO, headquarters or owner of the English language.... Cryptocurrencies provide a way for many to take control of their own financial sovereignty in a system that many are not happy with today. ”*** (Farzam Ehsani, Medium, My Open Letter to Jamie Dimon)

Cryptocurrency Investing - Objectives (GB.3180)

Academic Course Objectives

FOR STUDENTS:

1

To explore the fundamental aspects of cryptocurrencies and the liquid markets they operate in

- *The questions here: What are cryptocurrencies? What are the fundamental drivers behind certain cryptocurrencies including supply schedule, network effects and forks/segwitz? What are the types of exchanges that allow for investor transactions?*

2

To test select psychological biases/heuristics associated with these cryptocurrencies and the regulatory dynamics overlaid on it

- *The questions here: Are markets rational even if individual investors appear not to be? What is the nature of a 24-7 feedback loop? Is a crypto-fork a free dividend? What are the regulatory oversight being pursued for cryptocurrencies?*

3

To discuss practical implications of investing in these cryptocurrencies from limits to arbitrage to portfolio impacts across a range of asset classes

- *The questions here: Is there a “law of one price”? If the market price is not right, can we exploit irrationality via predictive trading strategies? Do you get compensated for idiosyncratic risks in crypto markets? What is the impact of including cryptocurrencies in a portfolio of traditional assets?*

- *We approach this analysis of investing in cryptocurrencies by also comparing it to traditional asset analysis (eg. Stock picking vs. coin/token picking) and using the lessons learned in that asset class to assist with cryptocurrency management*
- *There are over 1000 tokens listed on exchanges throughout the world with Bitcoin & Ether being the two biggest in market capitalization terms as of December 2017*

Cryptocurrency Investing – Class Sequencing (GB.3180)



Cryptocurrency Investing - Reading Lists By Class

Initial Readings By Class (To Be Supplemented by Practitioner Articles)

1

Reading on NYU Classes

- “Bitcoin: A Peer-to-Peer Electronic Cash System,” Nakamoto (2008)
- “The Great Chain of Being Sure About Things”, The Economist (2015)
- “A Legal Analysis of the DAO Exploit and Possible Investor Rights,” Bitcoin Magazine (2016)

2

Reading on NYU Classes

- “Bitcoin: A Peer-to-Peer Electronic Cash System,” Nakamoto (2008)
- “The Great Chain of Being Sure About Things”, The Economist (2015)
- “Global Cryptocurrency Benchmarking Study”, Cambridge Center for Alternative Finance (2017)

3

Reading on NYU Classes

- “Noise,” Black (1986)
- “Corporate Governance and Blockchains,” Yermack (2017)
- NYDFS, Bitcoin License Regulation
- “Digital Currencies, Decentralized Ledgers and the Future of Central Banking”, Raskin and Yermack (2017)

4

Reading on NYU Classes

- “Bank of Canada’s Blockchain Tests Spotlight Challenges,” Ho (2017)
- “Central bank cryptocurrencies”, BIS Quarterly Review, Sept 2017
- Variety of Reddit and Medium articles

5

Reading on NYU Classes

- “Investor Sentiment & the Cross-Section of Stock Return”, Baker & Wurgler (2003)
- “CBOE Bitcoin and Bitcoin Futures Whitepaper” (2018)
- “The Case for Bitcoin for Institutional Investors”, Liew and Hewlett (2017)

Cryptocurrency Investing - Timetable (GB.3180)

Class Timetable & Format

Month	September 2018				October				November				
Week			25	2	9	16	23	30	6				
Class Schedule	Classes 1 - 6 (in KMEC 4-120, 6-9pm)												
Assignment # Due Dates	No 1. Due 10/2 Review DAO and Tazos structures & Implications								No 4. Due 10/30 Exchange Breaks & Hacking? Correlations with Traditional Assets?				
					No 2. Due 10/16 Analyze Bitcoin & Bitcoin Cash Hard Fork				No 3. Due 10/23 What Law of One Price? Coins and Howe Test?				
Exam	Final Exam (90 mins, starts 6pm, Nov 6)												

Dates & Exclusions

- Classes for behavioral finance will be videotaped and be held in KMEC 4-120. Six classes are scheduled 6-9pm from Tuesday September 25, 2018 to Tuesday November 6, 2018
- There is no class on October 9 (UG Legislative Day at NYU)

Class Format

- You are strongly encouraged to attend each class given the discussion & instruction format chosen for this subject. Classes are divided into two parts
- In the first half of each class we will be walking through a variety of whitepaper and emerging token case studies. Class participation represents 20% of the final grade. Please bring your name tags
- In the second half we will take the experimental aspects discussed in the first part and overlay them into a framework (to mesh the academic and practical aspects of this course)

Cryptocurrency Investing (GB.3180)

Course Design, Exclusions and Grading Overview

1 Weekly lecture (6 lectures x 3 hours each, 6pm-9pm)

- Each class begins with a series of real-life observations & experimental cases (handed out and discussed in class)
- There is extensive reading both in lecture notes and assigned readings. The lecture notes are extremely detailed (as they act as the textbook reference) and as such do not follow the format of simple bullet points
- Six to eight key articles to be read as part of each class. Readings comprise a mixture of academic journals (eg. NBER papers) and newspaper/popular/blog press (eg. The Economist, Medium, github, R3CEV). In select cases, we are able to see how academic research is interpreted by mass media (which in turn are more commonly read by traders and investors). Journal readings posted on NYU Classes & press articles will be handed out in class
- Four take home cases or problems to be read and analyzed to reinforce classes each with graded assignment(s)

2 Course focuses on analysis as it relates to liquid tokens (not private blockchain companies or pre-Initial Coin Offerings [ICOs]). Focus on practitioner considerations as a fund or portfolio manager (within academic framework)

- Note: **This is not a course on crypto-trading**, but rather how to theoretically & practically incorporate traditional financial analysis into models for crypto-asset pricing for investing purposes
- Excludes detailed review of corporate finance, Excludes allocation of resources to non-publicly traded asset classes (eg. Pre-ICO), Excludes considerations in “over the counter” (OTC) markets, **Excludes detailed review of blockchain or foundations of fintech (other NYU CS and NYU Stern courses offer these)**

3 Grading structure

- 60% - closed book, in-class exam (final class, 90 minutes)
- 20% - class attendance & participation for each of first five classes
- 20% - 4 mini-assignments based around set problems or set cases
 - To be submitted individually or as a group, each assignment worth 5% (refer also “collaboration”, page 6)

4 All required readings and cases will be on NYU Classes or handed out in class (no textbook/coursepack)

Course Orientation – Ecosystem : Class 1

Interaction of Cryptocurrencies, Key Players Relative to Traditional Market Investors

1

List course objectives, grading and structure

2

Discussion of coin instruments and organization structure it operates in (linked to projects, corporations or foundations)

3

Step-by-step build-up of conceptual framework for analyzing cryptocurrencies

- Explanation of instruments & market price (outcome between buyer/seller decision)
- Identify components of buyer/seller decision collectively and the market participants in the ecosystem (developers, miners, investors, regulators)
- Key areas of focus for fundamental parameters that differ from traditional markets
- Key areas of focus of behavioral and regulatory dynamics
- Relevance of both markets to understanding (why it matters?)

4

A brief review of the concept of markets

- Crypto market (focus in this course) versus other markets/games such as
 - Stock Market
 - Gaming coins, Horseracing, Casino Games (poker, roulette etc)

5

Revisit select economic paradigms

- Dual Spending Problem
- Probability Distributions (Normal v. non-normal distributions, Discrete v. continuous time)

Learning Objectives

- What is a cryptocurrency?
- What is the underlying entity the crypto is linked to (project, corporation or foundation)?
- Who are the key players in the ecosystem? What are their motives and how to balance them? Consensus v. equilibrium

Classroom exercise

- Review of Satoshi Bitcoin Whitepaper

Reading on NYU Classes

- “Bitcoin: A Peer-to-Peer Electronic Cash System,” Nakamoto (2008)
- “The Great Chain of Being Sure About Things”, The Economist (2015)
- “A Legal Analysis of the DAO Exploit and Possible Investor Rights,” Bitcoin Magazine (2016)

Assignment 1 (to be handed in next class)

- Problem to be posted on NYU Classes

Fundamental Drivers: Class 2

Supply Schedule, Network Effects and Forks/Segwitz

1

Identify key parameters within any Crypto White Paper

- What are the key drivers?
 - Supply Schedule
 - Mining Algorithm & Pre-Mining
 - Block Size, Difficulty and Adaptability
 - Coder Pedigree, Use Cases
 - Consensus and Resolution Mechanism
- Explore concepts relative to traditional stock market (cash flows, growth, risk premia)

Learning Objectives

- What are key fundamental drivers of a cryptocurrency or coin?
- How do you analyze demand versus supply?
- What data sets market prices? What is the difference between noise & information?

2

Key traits (“decision mindset”) of demand versus supply dynamics

- Proof of Work, Proof of Stake
- Soft and Hard Forks
- Discussion of utility maximization v. prospect theory?
- Global versus regional dynamics

Classroom exercise

- Experimental (flash cards in class)
- Who are you? Spock v. McCoy? Animal spirits?

3

Revisit select economic paradigms

- Equilibrium pricing and consensus mechanism
- Network effects & Metcalfe’s Law
- Anti-fragility

Reading on NYU Classes

- “Is Bitcoin a real currency,” Yermack (2013)
- “How to Time-Stamp a Digital Document,” Haber and Stornetta (1991)
- “Smart Contracts – 12 Use Cases for Business,” Chamber of Digital Commerce (2016)

Assignment 2 (to be handed in next class)

- Problem to be posted on NYU Classes

Behavioral & Regulatory Dynamics: Class 3

Global Feedback Loops, Prospect Theory and Jurisdictional (Regional) Regulatory Rules

1

Discussion of information sources & sets

- Information Sets
 - Past prices, current announcements, insider information
- Noise v. Relevant Information
 - Role of media in setting mood (sentiment, feedback loops)
 - Presentation of information (framing, prediction addiction)
 - Data series (noise v. information)
- Potential consequences (dependence, momentum)

2

Investors biases based on information & reaction time

- Representativeness
- Anchoring & Availability
- Overconfidence v. Conservatism

3

Regulatory approaches to legal classification and enforcement

- USA Howey Test
- ICO & Zurich Foundations (vs. Venture Capital raisings)
- Listed options and futures on Regulated Exchanges

4

Revisit select economic paradigms

- Random Walk & Momentum (“Markets have no memory, No free lunch”)
- Event Studies (eg. Post-earnings announcements), Non-stationarity

Learning Objectives

- How is this information evaluated & reflected? Do different investor types have different reaction times?
- What are the implications on market price from feedback loops, volatility clusters and trading v. clock time?
- What are legal approaches to regulation?

Classroom exercise

- Global sweep of regulatory dynamics and focus on USA Howey Test

Reading on NYU Classes

- “Noise,” Black (1986)
- “Corporate Governance and Blockchains,” Yermack (2017)
- NYDFS, Bitcoin License Regulation
- “Digital Currencies, Decentralized Ledgers and the Future of Central Banking”, Raskin and Yermack (2017)

Assignment 3 (to be handed in next class)

- Problem to be posted on NYU Classes

Exchange Issues & Arbitrage Limits: Class 4

Market Frictions, Storage, Hacking & Market Anomalies

1

Limits to arbitrage

- Security type (geography)
- Strategy limitations (shorting, options, futures)
- Storage (Wallets, Cold & Warm), Taxes, liquidation preferences and other frictions



Learning Objectives

- What is arbitrage – academia v. real world?
- Are there limits to arbitrage?
- What are these limits?
- What are market anomalies and do they contradict efficient markets?

2

Documented case studies & anomalies

- Three recent case studies
 - Mt Gox, other hacks
 - Bid-Ask spreads, latency arbitrage
 - Prices of bitcoin in US, Korea, Japan exchanges
- Patterns/puzzles that appear to contradict efficient markets
 - Momentum Effects
 - Predictability Puzzle



Classroom exercise

- Mt Gox
- Order Book Depth



Reading on NYU Classes

- “Bank of Canada’s Blockchain Tests Spotlight Challenges,” Ho (2017)
- Various Medium and Reddit Posts

3

Revisit select economic paradigms

- Arbitrage Theory (“No Free Lunch v. Risky Lunch”)
- The Law of One Price
- Fragmented Liquidity (not Fractional Reserve?)



Assignment 4 (to be handed in next class)

- Problem to be posted on NYU Classes

Price & Portfolio Dynamics : Class 5

Representative Investor v. Wisdom of crowds and Implications on Portfolio

1

Aggregation of multiple buyers & sellers results in?:

- Whales (Big Investors, pre-mining)
- Representative investor
- Diversity, heterogeneity & wisdom of crowds (group think v. crowd think)

2

Review real-world trading strategies based on biases & anomalies

- Beta Trade
- Activist Trade (eg. Relative trade in terms of BTC)
- Theme Based Trade (eg. privacy, utility tokens etc)

3

Myth Busters

- Bitcoin is used for.....money laundering? Dark web? Completely Anonymous? etc

4

Revisit select economic paradigms

- Alpha (α), beta (β), error (ϵ) in risk-return models
- Diversification & correlation (what happens to diversification when crypto is added to mix?)
- Volatility skews

Learning Objectives

- Do individual biases compound or cancel out at a market level?
- What happens when crypto is added to a mix of other instruments?
- What is the institutional investor level of interest?

Classroom exercise

- Coinbase growth in accounts and liquidity
- Tether and BaseCoin

Reading on NYU Classes

- “Investor Sentiment & the Cross-Section of Stock Return”, Baker & Wurgler (2003)
- “CBOE Bitcoin Reference Rate for Futures” (2017)
- Various Medium and Reddit Posts

Exam & Emerging Areas of Crypto-Finance: Class 6

1

Exam (90 minutes, closed book)

- Closed book, no notes but a non-programmable calculator is allowed
- In class
- 60% of grade for course

2

A look at other areas in crypto-finance

- Smart contract construction
- Venture Capital Token Offering
- Disintermediation of other business lines (eg. Titles)

Learning Objectives

- Examination
- Discussion about other areas of crypto-finance not covered in detail

Cryptocurrency Investing (GB.XXXX)

Other Logistics

Materials

There is extensive reading both in lecture notes and assigned readings. The lecture notes are extremely detailed (as they act as the textbook reference) and as such do not follow the format of simple bullet points. There is no coursepack or assigned textbook for this class due to the emerging areas of research and findings in this field. This course outline has been posted (in NYU Classes) has been posted that cross-references the class-by-class syllabus (following pages) with the readings that will be provided on NYU Classes (or in class).

Pre-Reading

Preliminary lecture notes will be posted each week prior to the class to stimulate the assigned readings and provide impetus for class discussion. The preliminary lecture notes are purposely left incomplete (eg. tables are blank & will be completed through class participation). Final lecture notes will be posted after the class (in NYU Classes). Assigned readings, 6-8 per week will comprise 3-4 academic journal pieces (eg. NBER) and 3-4 from newspapers/press (eg. The Economist, R3CEV etc). Press articles will be handed out in class

Assignments, Collaboration & Feedback

Each assignment is due 1 week after posting on NYU Classes (per timetable on prior page). You are permitted to work with other students in analyzing problem sets and, if you work in a group, each group paper when submitted must clearly disclose the student members. The mini-assignments (four in total worth 20% of final grade, to be submitted individually) will be posted to NYU Classes after each class and are to be handed in-person at the next class

General solutions will be posted to each assignment on a weekly basis. The solutions will identify the overall student body's strengths and areas for improvement in tackling the problem set. (Note: There can be a delay in processing solutions if students do not submit their assignment responses on a weekly basis. No points will be awarded to students who do not provide advance notice of a delayed response)

Students requesting individual assessment of their assignment can obtain direct feedback by making an appointment. No individual assignments will be handed back to students. Prior courses have revealed that students develop a stronger understanding of materials through direct contact as each student has different areas of focus

Appendix: Default Policies and MBA Stern Honor Code

Behavior & Classroom Attendance

- Your behavior should respect your classmates' desire to learn. Students are expected to arrive to class on time and stay for the class period. Attendance is required as part of the grade. Please turn off cell phones during the class.
- Students unable to attend class or submit assignments on time are required to inform the instructor at least 48 hours in advance to avoid penalty.

Code of Conduct

- You are responsible for maintaining Stern's code of conduct which mandates zero tolerance for cheating and plagiarism. Violations of the code of conduct will be prosecuted with a minimum penalty of failure for the course, as required by the code of conduct rules. If you become aware of any violations of the code of conduct you must take whatever steps are necessary to stop the violators.

Collaboration on Graded Assignments

- You are permitted to work with other students in analyzing problem sets but each student must clearly disclose who they worked with.

Office Hours & Feedback

- You are welcome to set up an appointment by email to discuss the course material and assignments.

Grading

- MBA students who do not submit Course Faculty Evaluations by the deadline will not have access to their final grades until the grade release date, which is determined by the program.

Other Accommodations

- If you have a qualified disability and will require academic accommodation during this course, please contact the Moses Center for Students with Disabilities (CSD, 998-4980) and provide me with a letter from them verifying your registration and outlining the accommodations they recommend. If you will need to take an exam at the CSD, you must submit a completed Exam Accommodations Form to them at least one week prior to the scheduled exam time to be guaranteed accommodation.