Foundations of FinTech

Course #INTA-GB.2380.20 and .21

Classroom TBD

Spring 2018-weekly dates will be updated

Professors: David Yermack, Vasant Dhar, Yannis Bakos, Kathleen DeRose
Teaching Fellow: Rohith Sannapareddy

Course Description:

“FinTech” refers to financial sector innovations involving technology-enabled business models that can facilitate disintermediation, revolutionize how existing firms create and deliver products and services, address privacy, regulatory and law-enforcement challenges, provide new gateways for entrepreneurship, and seed opportunities for inclusive growth.¹

FinTech is also the label for increasingly technological approaches to the main financial intermediation functions: payments, capital raising, remittances, managing uncertainty and risk, market price discovery, and mediating information asymmetry and incentives. In today’s FinTech businesses, consumers bank via mobile apps integrated into social media, institutions trade electronically, and robo-advisers make decisions about investment portfolios.

This inter-departmental course provides an introduction to the emerging FinTech discipline. It is intended to be the starting point for Stern students who may take

¹ See: [http://www.stern.nyu.edu/programs-admissions/full-time-mba/academics/specializations/fintech](http://www.stern.nyu.edu/programs-admissions/full-time-mba/academics/specializations/fintech)
additional electives in the FinTech area, while also providing an overview of the area for students who intend to take only one FinTech course.

The course will study:

- How is financial innovation different than industrial innovation? How is financial innovation evolving? What are the light sides and dark sides of financial innovation?

- Will traditional financial intermediaries be able to adapt? Or will upstart FinTechs disrupt them, re-imagining business models just as Amazon reshaped book-selling and Uber transformed taxi-rides?

- What are the critical technology strategies and foundational technologies in FinTech?

- What are the core and novel sources of FinTech data, how are they managed? How is data visualization evolving?

- What are the primary FinTech data science methods and tools? How do they apply to real FinTech problems and questions today?

- How is FinTech reconfiguring financial services business models? What are the key disruption points? What determines success in FinTech?

- Where are the limits, risks, and broader policy and social implications of FinTech?

**Grading:**

45% Problem sets and case questions
   15% from classes 3-15
   30% from classes 17-20-case studies
35% Midterm: October 26th
20% Final Exam: TBD December 18-22
Class participation is expected

**Course Readings and Cases:**

Please see syllabus below and NYU classes (resources, by week for all course readings, case studies, and lecture slides)

**General Conduct and Behavior**

Students are expected to maintain and abide by the highest standards of professional conduct and behavior. Please familiarize yourself with Stern's Policy in Regard to In-Class Behavior & Expectations (http://www.stern.nyu.edu/portal-partners/current-students/undergraduate/resources-policies/academic-
policies/index.htm) and the NYU Disruptive Behavior Policy (http://www.nyu.edu/about/policies-guidelines-compliance/policies-and-guidelines/bullying--threatening--and-other-disruptive-behavior-guidelines.html).

In particular this means: (a) attendance is mandatory – if you cannot make it you must get permission from the instructor to miss class, (b) no personal use of electronic devices in class (only note taking is allowed), and (c) display your name cards at your seat so the instructor can get to know you.

**Academic Integrity Above All:**

Integrity is critical to the learning process and to all that we do here at NYU Stern. As members of our community, all students agree to abide by the NYU Stern Student Code of Conduct, which includes a commitment to: (a) Exercise integrity in all aspects of one’s academic work including, but not limited to, the preparation and completion of exams, papers and all other course requirements by not engaging in any method or means that provides an unfair advantage. (b) Clearly acknowledge the work and efforts of others when submitting written work as one’s own. Ideas, data, direct quotations (which should be designated with quotation marks), paraphrasing, creative expression, or any other incorporation of the work of others should be fully referenced. (c) Refrain from behaving in ways that knowingly support, assist, or in any way attempt to enable another person to engage in any violation of the Code of Conduct. Our support also includes reporting any observed violations of this Code of Conduct or other School and University policies that are deemed to adversely affect the NYU Stern community.

The entire Stern Student Code of Conduct applies to all students enrolled in Stern courses and can be found here: www.stem.nyu.edu/uc/codeofconduct

To help ensure the integrity of our learning community, all assignments that you submit via the course’s NYU Classes website will be routed through Turnitin, which will compare your submission to a database of prior submissions, current and archived Web pages, periodicals, journals, and publications. Your document will automatically become part of the Turnitin database.

**Students with Disabilities:**
If you have a qualified disability and will require academic accommodation of any kind during this course, you must notify the instructor at the beginning of the course and provide a letter from the Moses Center for Students with Disabilities (CSD) at Tel. (212) 998-4980 or www.nyu.edu/csd) verifying your registration and outlining the accommodations the Center staff recommends. If you will need to take an exam at the CSD, you must submit a completed Exam Accommodations Form (EAF) to them at least one week prior to the scheduled exam time to be guaranteed the alternative venue.

Syllabus:

**Week 1**

1. **Class 1: DY: Course Introduction: the FinTech opportunity to improve the financial system**
   - **Read:** Citi GPS, 2016, Digital Disruption: How FinTech Is Forcing Banking to a Tipping Point, available at https://ir.citi.com/SEBhgbdvxes95HW2MmFbjiU%2FydQ9kbvEbH1ruHR%2Fl e%2F2Wza4cRvOQUNX8GBWVsV

   - **Read:** The Economist, To do with the price of fish, http://www.economist.com/node/9149142

**Week 2**

3. **Class 1: YB: Encryption and Information Security**


• Read: Michael Scott, The Essence of the Blockchain. Published 30 August 2016. Available at http://www.miracl.com/hubfs/block.pdf?hsCtaTracking=41b86e7e-0bc6-48f0-889a-61bd43021a32%Cab2522ad-e26f-4487-b0f3-b251481190c8
• Read: Chapter 2: Blockchain Technology, in Matteo Biela and Vittorio Zinetti, Blockchain Technology and Applications from a Financial Perspective. Available from NYU Classes.

Week 3

5. Class 1 YB: Blockchains and Cryptocurrencies, Part 2: The cryptocurrency ecosystem, present and future

6. Class 2: YB: Blockchains and Cryptocurrencies, Part 3: Payment Systems; Blockchain as infrastructure
• Read: Sally Percy, What is the Cheapest Way to Send Money Abroad? The Telegraph, 7 April 2016 http://www.telegraph.co.uk/money/transferwise/the-cheapest-way-to-send-money-abroad/
• Read: Bob Mason. What is an ICO (Initial Coin Offering) and How Does it Work? FXEmpire blog post, June 2017. Available at https://www.fxempire.com/education/article/ico-initial-coin-offering-work-418446
• Read: Gideon Greenspan, Ending the bitcoin vs. blockchain debate. Blog post July 20, 2015. Available at https://www.linkedin.com/pulse/ending-bitcoin-vs-blockchain-debate-gideon-
greenspan.

Week 4

7. Class 1: YB: Privacy and financial data


Week 5

   - **Concepts covered**: deduction versus induction, supervised and unsupervised learning, target variable, classification versus regression (Learning versus specifying a model, Feature engineering, Decision Trees, Bayesian thinking)
   - **Broad questions**
     Q11: What does it mean for a machine to generate and test hypotheses? Are machines capable of doing Science?
     Q12: How is machine learning different from database querying?
   - **Read**: Dhar, V., Data Science and Prediction, Communications of the ACM, volume 56, number 12, December 2013
   - **Read**: Provost and Fawcett, Data Science for Business, Chapter 3, Introduction to Predictive Modeling: From Correlation to Supervised Segmentation

    - **Concepts covered**: feature engineering, model bias, overfitting, randomness and baseline performance, in-sample performance versus generalization performance, learning curve, fitting curve (Learning Curves, Fitting Curves, Overfitting Avoidance, Comparing Learned Models)
    - **Broad questions**
      Q21: What is feature engineering and why is it essential to machine learning?
      Q22: Does more data lead to better predictive models?
      Q23: What is “overfitting” and how can it be avoided?
    - **Read**: Provost and Fawcett, Data Science for Business, Chapter 5, Overfitting and its Avoidance
Week 6

11. Class 1 VD: How Do We Evaluate Machine Learning Models?
   - Concepts covered: ROC curves and AUC for classification, MSE, MAPE, Sharpe Ratios for regression
   - Broad questions
     Q31: How can you compare classifiers when costs and benefits are known?
     Q32: How can you compare classifiers more generally?
     Q33: Under what conditions do false positives and false negatives matter?
   - Read: Provost and Fawcett, Data Science for Business, Chapter 8, Visualizing Model Performance
   - Read: Dhar, V., Big Data and Predictive Analytics in Healthcare;, Big Data, volume 2, issue 3, September 2014
     http://online.liebertpub.com/doi/pdf/10.1089/big.2014.1525

   - Concepts covered: Neural Nets, Convolutional Nets, how perception works, local correlation structure, role of data in DL
   - Broad questions
     Q41: How can deep nets do automated feature engineering?
     Q42: (How) can automated feature engineering be done on “traditional” business data?
   - Read: Dhar, V., and Stein, R., Chapter 6 “Neural Networks’ from Seven Methods for Transforming Corporate Data Into Business Intelligence, Prentice-Hall, 1997.
   - Read: Machine Learning is Fun! Part 3: Deep Learning and Convolutional Neural Networks

Week 7

13. Class 1: VD: How Big Data Changes Things
   - Concepts covered: expected value framework, autonomous learning systems, predictability, error cost, trust
   - Broad questions
     Q51: When Should We Trust Machines With Decision-Making?
     Q52: How Can Leaders Prioritize Potential Data Science Initiatives?
     https://hbr.org/2016/05/when-to-trust-robots-with-decisions-and-when-not-to

14. Class 2 VD: AI Platforms and Fintech data & applications
• **Broad questions**
  Q61: How does AI shift the boundaries of work between machines and humans?
  Q62: What is the likely impact of AI on FinTech and jobs in Finance?


• **Read:** [https://www.predictivanalyticstoday.com/artificial-intelligence-platforms/](https://www.predictivanalyticstoday.com/artificial-intelligence-platforms/)

15. **Class 1 VD & YB: Review Session**
16. **Class 2 ***MIDTERM EXAM***

**Week 9**

17. **Class 1 KD: Intro to Disruptive Technology Cases in FinTech (all the below are short)**
   • **Read:** Haycock, James, and Richmond, Shane. (2015). Bye Bye Banks? How retail banks are being displaced, diminished, and disintermediated by tech startups and what they can do to survive. London, U.K. Wunderkammer, Adaptive Lab
   • **Read:** [https://www.fnlondon.com/articles/fintech-partnerships-reveal-banks-innovation-insecurities-20170406](https://www.fnlondon.com/articles/fintech-partnerships-reveal-banks-innovation-insecurities-20170406)
   • **Read:** Nixon, Brian, (2017) An Inflection Point for Wealth Management [https://search.proquest.com/openview/6eb323d349d9ac1b19b9841c85ab8fccc/1?pq-origsite=gscholar&cbl=47754](https://search.proquest.com/openview/6eb323d349d9ac1b19b9841c85ab8fccc/1?pq-origsite=gscholar&cbl=47754)
   • **Read:** [https://www.forbes.com/sites/mergermarket/2017/05/31/b2b-fintech-investment-on-the-rise/](https://www.forbes.com/sites/mergermarket/2017/05/31/b2b-fintech-investment-on-the-rise/)

• **Group in-class work:** Construct competitive maps for the five primary financial functions (Competitors, Profits, and Technology)

18. **Class 2 KD: Payments and Money Transfers: Pirate Booty**
   • **Read:** Pirate Booty Case
   • **Prepare Case Questions:** individual work, one page bullet point answers
     - Would you invest in Pirate Booty?
     - What is the biggest operational risk in Pirate Booty?
     - Pirate Booty does not have its own banking license. Advantage or disadvantage?

**Week 10**

19. **Class 1 KD: Markets and Price Discovery: Trumid**
   • **Read:** Trumid Case
   • **Prepare Case Questions:** individual work, one page bullet point answers
20. Class 2 KD: Capital Allocation: Betterment and Stash
- **Read**: Robo Investing Case
- **Prepare Case Questions**: individual work, one page bullet point answers
  - Should Betterment enter the retirement market?
  - How does Betterment use technology to address behavioral finance bias?
  - Is Betterment a “platform”?

**Week 11**

21. Class 1 DY: FinTech operational, technology, and regulatory risks
  - See also: Bitcoin Energy Consumption Index, available at http://digiconomist.net/bitcoin-energy-consumption
- **Read**: [Chinese bitcoin exchange rules expected to be issued in June 2017]


**Week 12**


***NO class*** (11/23 Thanksgiving)

(Note: the Deloitte report, which has been partly redacted by the Bank of England, can be downloaded by those interested at http://www.bankofengland.co.uk/publications/Documents/news/2015/rtgs_deloitte.pdf)


---

**Week 13**

**24. Class 1 KD: FinTech Company Valuation & Asset Bubbles**

- **Read:** Damodoran, Aswath. (2012). The Dark Side of Valuation. Available at: (www.pages.stern.nyu.edu/~adamodar/pdfiles/country/darkside2012extended.pdf)

**25. Class 2 DY: Using Insights from FinTech to Improve Financial Behavior**


---

**Week 14**

**26. Class 1 DY: Policy Implications for Regulators and Investors**


**27. Class 2 DY: Financial Inclusion and Exclusion**


**Week 15**

28. ***Last Class***

**2 KD: Robots, AI and the Labor Market After FinTech, and course wrap-up**

• **Read:** Dowd, Maureen (2017) Elon Musk’s Billion-dollar Crusade to stop the AI Apocalypse. Available at: https://www.vanityfair.com/news/2017/03/elon-musk-billion-dollar-crusade-to-stop-ai-space-x


• **Read:** Banks AI plans threaten thousands of jobs. Financial Times. Available at: https://www.ft.com/content/3da058a0-e268-11e6-8405-9e5580d6e5fb

**Final Exam TBD**