

## The Impact of FinTech and Data Analytics on Job Opportunities in Finance

Linda Kreitzman

4/26/2017

## Introduction

- Recent technological innovations have made possible the new financial intermediation offered by FinTech. Without the easy access to large digitalized dataset, the massive increase in storage capacity and processing capacities, especially with the "cloud", FinTech would not have emerged.
- Banking has historically been one of the business sectors most resistant to disruption by technology. Paul Volcker wasn't flattering the financial service industry when he said in 2009, that "the latest great innovation in banking was the ATM" but he had probably a point.
- There are times in history when inventions changed fundamentally how industries function. We may be seeing that right now.
- It's been a while since we've seen a game-changer, but Fintech may be one as well as Blockchain technology.
- FinTech is not a natural evolution in financial intermediation but a true revolution. The growth opportunities are huge. Venture capital funds were quick to recognize these opportunities.

- FinTech: refers to the technological start-ups that are emerging to rival traditional banking and financial players; it covers an array of services, from crowdfunding platforms and mobile payments solutions, international money transfers to online portfolio management tools.
- FinTech, digital innovations, easy access to larger digitalized datasets, storage capacities and processing capabilities are "*disruptive*" for many industries, especially the financial industry.
- Between 2010 and 2015 overall FinTech investment in 2,500
  FinTech firms reached \$50 bn (\$19 bn in 2015 alone).
- One major consequence of these technological improvements is *disintermediation*.
- The financial system is essentially an *intermediary* and is first in line to be disintermediated.



Source: Pulse of Fintech Q4'16, Global Analysis of Investment in Fintech, KPMG International (data provided by PitchBook) February 21, 2017.





Source: Pulse of Fintech Q4'16, Global Analysis of Investment in Fintech, KPMG International (data provided by PitchBook) February 21, 2017.

## **Context: Today**



Figure 2. Capital Deployed in Private FinTech Companies By Segment

#### Figure 3. Capital Deployed in Private FinTech Companies By Business Area



#### Source: Citigroup

### **Context: Tomorrow**

#### We see more than 30 areas emerging as new norms in banking.

#### Key fintech trends



McKinsey&Company | Source: Panorama by McKinsey



Digital attackers disintermediate profitable customer-facing businesses and avoid capital-intensive areas.



<sup>1</sup>Revenues generated by carrying loans and other assets already sold and sitting on the books. <sup>2</sup>Asset management includes investment and pension products. Only insurance sold by banks is included.

Source: Analysis and data provided by Panorama (a McKinsey Solution)



Origination and sales—the focus of nonbank attackers account for about 60 percent of global banking profits.

Global banking revenues and profits by activity, 2014, \$ billion

		Balance-sheet prov	ision	Originatio	on/sales
Core banking	Lending	1,239		301	
	Current/checking acco	unts 526		131	
	Deposits		174	× 44	
Fee-based businesses	Investment banking1		136	214	
	Transactions/payments	3	0,	4	83
	Asset management and	d insurance <sup>2</sup>	0,		577
	Total revenues	2,075 (54%)		1,75	50 (46%)
	Total after-tax profits	436 (41%)		621	1 (59%)
	Return on equity	6%		:	22%
					V

Credit disintermediation Customer disintermediation

<sup>1</sup>Corporate finance, capital markets, securities services.

<sup>2</sup>Asset management includes investment and pension products. Insurance includes bank-sold insurance only.

Source: Analysis of data provided by McKinsey Panorama (a McKinsey Solution)

McKinsey&Company



How FinTech is affecting the financial services value chain:





#### Payments system:

- Payment by mobile smartphone with credit/debit card, digital wallets, pre-funded eMoney.
- Bitcoins Blockchain technology that combines a number of mathematical, cryptographic techniques in order to maintain a database between multiple participants without the need for any third party validator or reconciliation: it is a secure and distributed ledger.

Could be used for:

- international payments and trading,

- transfer, clearing and settlement of digital assets without the need for an intermediary (clearing houses): NASDAQ exchange will soon start using a blockchain-based system to record trades in privately held companies.

- Blockchain-based land registry (Honduras, Greece)
- the automatic execution of "**smart contracts**" once the pre-agreed conditions have been met.



- Blockchain technology (Continuation)
- Several consortia:

- R3/Corda and member banks (42 international banks) are exploring these capabilities. Application to Trade Finance and complex workflows (shipping)

- Ethereum

- Digital Assets Holdings (DAH): to replace the Australian Stock Exchange post-trade infrastructure by a Blockchain solution.

 Also the Linux Foundation initiated an open-source project: Hyperledger, with IBM (MAERSK, Walmart), JP Morgan, Wells Fargo and Swift.

#### • Financing of firms:

 Crowdfunding: online platforms allow individuals and businesses to lend and borrow between each other or invest in the capital of companies (private equity).

More than 100 lending platforms in the US alone (LendingClub, Prosper, FundingCircle, Ondeck, Avant, Kabbage, SoFi, Square Capital...)

 With lending innovation, alternative new credit models have emerged, including automated loan approvals: Datamining/machine learning techniques for credit scoring using non traditional data sources (behavioural information, FaceBook, etc.) and powerful data analytics to price risks and lower operating costs.

#### Asset allocation:

Robo-advisors (automated investment advice): Advize, Fundshop, Marie Quantier, Yomoni, WeSave, Evest,...

- *How it works*: Investors fill in an online questionnaire detailing their investment amount, risk tolerance and expected returns.
- The platform then uses algorithms to place investments into various buckets (usually low-cost ETFs). In return, the platform charges management fee plus fund expenses.
- The platform also helps routinely rebalance the portfolio in-line with set allocations and can also offer other services such as automatic tax loss harvesting.



#### Robo-advisor: Currently AUM by Robo-advisor only \$40 bn



#### **Recent examples include:**

- BlackRock which announced the acquisition of FutureAdvisor in August 2015, taking the robo-advisor's platform, with plans to offer this to banks, brokerages and other clients of BlackRock Solution.
- In May 2015, Vanguard launched a hybrid service, offering clients access to robo-services and human advisors for just 30 bps.

#### Payments system:

- Payment by mobile phone
- Bitcoins Blockchain technology
- Financing of firms:
  - Crowdfunding
  - Datamining/machine learning techniques for credit scoring
- Asset allocation:
  - Robo-advisors
- Uncertainty management and risk control:
  - New risks: cyber risk and reputation risk

FinTech are emerging to help various organizations around the world to automatically 24/7 test their own cybersecurity measures and identify their main risks and the most cost effective way to protect their organization against hackers

• In the future, expect more institutional fintech that will come into play, and that may come out through banks. An interesting company to look at is **BestX**, which is making waves in FX.

•

### The "New" Risks and Uncertainties

- The new technologies change the risk landscape and introduce new risks such as :
  - Cyber risks- penetrating payment and settlement systems and stealing identities as well as financial information (see reading)
  - The risk of using new systems to support criminal activities e.g., employing Bitcoin to hide identities.
  - Reputation Risk: the risk of dissemination of false rumors through social media. Anticipate how to react if it happens.

## **A New Environment: Some Examples**

#### Human-Machine Interface will be more needed than ever:

- Humans will need decision support tools in an *automated environment*, and machines will have to *learn* from human understanding of the context.
- Example:
  - ✓ In a hedge fund, each trader can monitor 150 to 700 trading algorithms. Decision support tools attempt to predict on the fly the quality of trading of the many algorithms. If an explanatory variable explains bad performance, traders should take the decisions to halt some of the trading algorithms.
  - ✓ IBM Watson: After being "educated" for months to the bank's practices, Watson can answer emails from clients.
  - $\checkmark$  This requires the use of :
    - Big Data techniques
    - Machine learning algorithms

## **A New Environment: Some Examples**

- Insurance industry:
  - Usage-based insurance (e.g., auto insurance: pay-as-you-drive)
  - Smart contracts: imagine a car insurance that is embedded in the car itself and changes the premium paid based on the driving habits of the owner.

The car contract could also contact the nearest garages that have a contract with the insurance company in the event of an accident or a request for towing.

All of this could happen with limited human interaction.

# **Addressing The Challenge**

- Banks have created new C's positions:
  - CDO: Chief Digital Officer
  - CDO: Chief Data Officer
  - CIO: Chief Information Officer (Goldman Sachs)
- Banks are developing partnerships with FinTech: easy and flexible way to get involved with technology firms.
- 30% of Goldman Sachs headcount, i.e., 9,000 individuals, are engineers vs. 5 to 10% in most banks and 50% in technological companies.

## **Conduct and Public Policy Issues**

#### Conduct Issues

- Client suitability
- Anti-Money Laundering ("AML")
- Combating the Financing of Terrorism ("CFT")

#### Public Policy Issues

- The twin imperative of inclusion and more competition point to the value of "digital identities":
  - biometrics and cryptography are being used to validate customer identities (in 2010, the Indian government has issued more than 1 bn such identities: fingerprints and iris scans plus 12-digit identifying number - Aadhaar)

## **Potential Impact of FinTech on Financial Stability**

- Which FinTech activities constitute traditional banking activities by another name and should be regulated as such?
  - Those systematic risks associated with credit intermediation including maturity transformation, leverage and liquidity mismatch should be regulated consistently regardless of the delivery mechanism or credit algorithm.
- How could developments in the FinTech space affect the safety and soundness of existing regulated firms
  - (e.g., robo-advice and risk management algorithms may lead to excess volatility and increase pro-cyclicality as a result of herding, especially when underlying algorithms are overly sensitive to price movements or highly correlated).
- What are the implications for the aggregate level of cyber and operational risk in the financial system?

### **New Skills Needed for Finance**

FinTech & Tech are expanding — they want a **"full-stack" quant**, i.e. someone who is good at everything —

•Coding (<u>fast-implementation</u>: Python, R; <u>backend-support</u>: C++, Java, JavaScript; <u>database</u> <u>familiarity</u>: SQL, No-SQL) — so that he/she can make the actual product.

•Finance Intuition (pricing theory, market intuition) — so that he/she knows what he/she is doing

•Stats/Machine Learning (data-driven and AI-related models) — this is the hottest topic

Years ago, at an investment bank like GS, one needed to be very good at pricing. Nowadays, everyone needs some level of machine learning.

Changes in the industry brought the following:

1) The saturation of the "quant" positions in the sell-side

2) Some difficulty to place students in the buy-side b/c their programming is not strong enough.

3) The rise of the FinTech firms and FinTech activities among investment banks.

Given the above changes, there are two places where we need to adapt our curriculum to maintain competitiveness.

1) Increase pre-requisites in programming – Python, R, Q, etc.

2) Add more data-relevant classes — at the cost of traditional electives — coding and ML important courses to add to any curriculum now.

### **New Skills Needed for Finance**

Typically, finance students are weak in coding and statistics. It is important to take advanced coursework in these fields.

The typical finance student comes with:

- stochastic calculus modeling for model risk management
- probability theory for VaR calculations
- basic stats, such as linear regression and its variations
- **basic coding** (R, SAS, Matlab) for implementation and stress testing

Need for FinTech Firms:

- econometrics modeling, such as time-series and its variations
- machine learning, such as random forest and gradient boosting (Kaggle-level modeling)
- coding (Python, R) for productions-level codes
- database management (SQL and its variations) for data querying/pre-processing
- product intuition not required, but good for career advancement
- strong communication and people skills and capability to identify possible improvement for collaborations across teams.
- Text Analytics Skills.

At a firm like Citadel:

- independent research abilities most important as a quant researcher, should be able to know where to get new alphas they prefer people with relative experience to bring in new ideas
- cutting edge knowledge in at least one area (e.g., deep learning) very important to survive in a highly-competitive environment
- equity research fundamentals
- coding (Python, R) for fast implementation, and C++ for production

## **Interview Skills Tested**

#### Skillset

Nowadays firms are looking to evaluate the candidates on a scale of 1-5 along the following dimensions:

- SQL
- Programming
- Statistics/ML/IA
- Business interest and knowledge
- Communication Skills

## What a FinTech Firm Wants

#### SQL

1.SQL knowledge

2. Basic CRUD

3. Understands different JOINs, can use subqueries or temp tables, GROUP BY

4. Knows when to utilize window functions (ie PARTITION)

5. Understands implementation, can judge ahead of time when queries will be expensive, knows how to evaluate and optimize (ie EXPLAIN)

#### **Programming/Software Engineering**

- 1. Programming knowledge- R, Python, C++
- 2. Loops, if/else, print
- 3. Can write functions
- 4. Understands packages, has used git
- 5. Can use a debugger.

#### Statistics/Modeling

1. Statistical computing experience (R, Matlab, python science stack). Can run and summarize regressions, explain p-values, knows logistic regression, can plot data.

2. Understands common distributions and can explain where they are useful (binomial, exponential, Poisson, Gaussian)

3. Has built predictive models, understands feature selection and feature engineering, bias/variance tradeoff.

#### **Communication/Writing Skills**

### **Job Postings**

- BlackRock Global Allocation team is seeking a Researcher to develop systematic alpha signals and strategies driven by big data/text analytics research for our mutual fund. The successful candidate will be looking into new datasets, techniques and insights, and use these to create new alpha sources for the team and enhance the existing portfolio construction techniques, cooperating with expert researchers and quantitative portfolio managers.
- Explore new data sources to support our systematic security selection efforts.
- Conduct original and innovative big data research, predominately focused on text analytics and behavioral Finance
- Contribute to the development of systems and tools to enhance the Global Allocation investment process
- Contribute to broader research initiatives across BlackRock.

### **Text Analytics**

Text analytics (or text mining) is the process of deriving gainful information from text, usually through techniques like text categorization, text clustering, concept/entity extraction and sentiment analysis. An important goal of text analysis is to turn the text into data, via application of natural language processing (NLP).

## Sample Job From Goldman Sachs

#### Job Summary & Responsibilities

• Designing, developing, and implementing complex, profile based, surveillances with a strong emphasis on analytical models

• Developing quantitative solutions for key risks for compliance divisions across the firm (Global Surveillance, Securities division, Investment Banking, Merchant Banking, Asset Management, and Investment Research)

#### Some of the key concepts which the team is and has been working involve:

- Behavior Modeling
- Abnormal return analysis
- Performance analysis, contribution analysis
- Internal/external transaction analysis
- Market Manipulation scenarios
- Transaction analysis, Profit calculations
- Risk scoring systems
- Statistical Analysis
- Text analytics
- Relationship Modeling

#### **Basic Qualifications**

- Knowledge and proficiency in software coding in Java, C, or C++
- Comfortable with coding, working with large data, and use of statistical software packages
- Experience and /or comfortable working in Hadoop infrastructure
- Expertise in signal processing, target detection and tracking algorithms, and threat warning
- Knowledge of machine learning and cognitive algorithms, and future-thinking developments
- Ideal candidate to have exposure to quantitative concepts in any/multiple of the below:
  - Quantitative risk management and portfolio theory
  - Econometric modeling and financial analysis
  - Analytics in order and trade flows, high frequency algorithms
- Knowledge of the financial industry, specially products in equity, fixed income, credit derivatives, and structured products

• Successful applicants will have degrees (preferably a master's degree) and backgrounds in one or more relevant disciplines, such as computer science and engineering, applied mathematics, and experience in the financial industry or has a BS in computer science and is working towards obtaining their CFA credential, or have MBA in Finance with an engineering background or MFE.

### Example: Berkeley MFE Alumnus moves from IB 2011-2016 within Financial Institutions Group to Crowd Funding

#### Quant Skills used at Investment Bank:

- Derivative Structuring / Modeling / Valuation
  - Equity Derivative Modeling
  - Interest Rate / FX Derivative Modeling
  - Path dependent options
  - American style options
- Volatility and Correlation Modeling
- Estimating derivative greeks (second and higher order greeks) and designing hedging strategies / hedge portfolio optimization
- Monte Carlo Simulation techniques and Finite Difference Methods
- Stochastic Calculus
- Understanding of Exotic structures
- Risk Modeling: Value at Risk (VaR), Conditional Tail Expectation (CTE), Key Rate Duration
- Accounting / Taxation impact of derivatives
- Understanding financial market structure / market participants
- Programming in C++ / Java

#### Quant Skills used at a FinTech Firm now:

- Data science and machine learning / predictive modeling techniques (understanding client needs)
  - Logistic regression
  - Decision trees
- Extensive use of statistics
- Understanding financial market structure / market participants/Programming - mainly Python, SAS, R, SQL
- Big Data techniques, architecture and platforms
- Efficient portfolio construction techniques (potentially used at both robo-advisors and online lending firms)
- Understanding of Blockchain technologies

- Fewer jobs in finance.
- Still, there are jobs in finance- Sales and Trading- from products to selling solutions now (sales folks must be more technical now).
- Profit margins on new products are so small that, to compensate, banks are selling solutions to clients (ex: investment strategies to insurance companies)
- Strats: Data scientists? Algo traders for instance.

- Is the Quant becoming a Data Scientist?
- Need to introduce Data Science in MFE Curricula in the U.S.
- Industry tools: ML systems (editors, git, programming languages such as R and Python & Q .
- Collaboration tools used in industry like SLACK
- Python for scientific computation and machine learning-Python libraries to develop big data models.
- Data collection and processing- to obtain large datasets from the web for instance and other sources: Twitter, government databases.
- Data storage like storing data in the cloud. AWS Secure Storage.
- Data cleaning to remove noisy information from datasets
- ML models: problem definition and model development like models and packages for classification, regression and portfolio allocation problems.
- Model evaluation
- Building ML models at scale.

- Caution: the finance industry does not need "just programmers."
- Strong interest in our students from Uber, Unison, Google, Facebook, etc. and Fintech industry.
- We work with the industry and help develop our students' intuition.
- Students themselves want to work in FinTech-more challenging field and a better culture. Why?
- Not much innovation in financial engineering: we seem to maintain models, use of classic equity and fixed income models. Adaptation of old models to structured products.
- Risk management: systemic risk: stress testing scenarios, credit risk analysis (CCAR: regression models, not mathematics).
- Need for skills in programming and statistics.
- Operations research skills are needed too- I think that is what tech industry is lacking, i.e. ability To convert a business / social problem into a ML problem. That skill is more OR than ML, although people may not even differentiate these two fields these days.



#### Will fintech kill your banking job?

by Simon Mortlock 28 September 2015



Aiming for your job



- We prepare our students very well for the new industry challenges!
- The Fintech Industry is still in development. It is undoubtedly an area of finance that has huge potential growth. Whether all Fintech firms succeed in the future has yet to be seen but Fintech as a whole has huge potential.
- Students attending this conference: Reach out to me!
- Firms attending this conference: We need your support! Industry Projects Internships /FT Positions

### THANK YOU!