Future of Finance
Fudan Custom Program

R.A. Farrokhnia (Faculty Director)
Columbia Business School

Hello!

I am R.A. Farrokhnia (*far.oak.nia*).
I teach and research at Columbia Business and Engineering Schools.
I do **imagineering** at the intersection of academia & practice.

Faculty Introduction

- At the intersection of “**academia and practice**”
- Recipient of Dean’s Award for Teaching Excellence
- Founding Executive Director of “**Advanced Projects and Applied Research in Fintech**” at Columbia
- Interdisciplinary (Econ/Finance, Engineering/Tech, Design)
- Next-generation DevLab (fintech, data/AI, enterprise software & solutions) & working with startups and VCs

Today's Lecture (in Two Parts)

Part 1 & 2:

- A look into the Now and the Future of Fintech (Tech Stack, ML/AI, Blockchain, DeFi), in both enterprise & consumer settings

Part 3:

- Innovation models and a roadmap to creating centers of innovation excellence; lessons from 3 years of research from Silicon Valley & beyond

Part 1

Fintech: Consumer & Enterprise

The Now & The Future: What is on the Horizon?

What is Fintech?!

Is there a standard definition?

> *"**The word Fintech is a bit overused**," said R.A. Farrokhnia, a professor at Columbia Business School and School of Engineering and Applied Science. "**Saying something is driven by tech is akin to saying fire is driven by oxygen.**"*
>
> *The New York Time; April 6, 2016*

Technology in Finance: Historic Perspective

- Application of technology and computational tools in finance and banking, applicable in many other industries
- In essence, any company can be a Fintech company!
- But let's build a mental model to frame our discussion today ⟶

A Simple Model

Setting up a mental model to discuss Fintech evolution and its industry-disruptive potential

About the Future

“Prediction is very difficult, especially if it's about the future!”

Niels Bohr, Danish Physicist

Evolution of Fintech

Passive Fintech

Autonomous Fintech

Intelligent Fintech

Technology in Finance: Historic Perspective

- Application of technology and computational tools in finance and banking
- Starting in 1950's, accelerated in 70's and 80's …
- … but mostly for back-end systems (enterprise)
- Big growth with the advent of the internet in the 90's for both consumer & enterprise, but mostly reactive/passive
- Major catalyst for massive growth, launched in Jan 2007 →


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Kalendarz
Zdjęcia
Aparat
Zegar
18
Przypomnienia
Notatki
Dom
Pogoda
Narzędzia
Mój Mac

Six Focus Areas & Examples of Fintech in the U.S.

Trading
Robinhood

Insurance
Lemonaid

Payments
Zelle

Automation
IFTTT

Investing
Composer

Crypto/Web3.0
Many examples!

Technology in Finance: The Now

- Smartphones: a computer in our pockets with GPS + camera + browser + connectivity (always on)
- Data everywhere we can collect … mobile devices, desktops, online interactions, etc. ⟶ behavioral analyses
- Banking consolidation ⟶

14,125 banks

1934 / 3,112 branches

10,142 banks

1994 / 59,175 branches

4,135 banks

2022 / 71,190 branches

Total number of FDIC-insured commercial banks in the U.S. Source: FDIC.gov

Technology in Finance: The Now

- Centralized systems (will come back to this later)
- Networks were the big bets (telecom, social, etc.)
- More capabilities added to internet banking (not just for checking balances!), with more continuously added
- Trust still important … but big banks are no longer the only sources (more consumers open to the new things)
- The fast change of pace in today's world

Technology in Finance: Near Term

- Decentralized systems (esp blockchain-based)
- Digital tokens and currencies (nothing new!)
- No longer need trust → algos and math provide it
- Open banking and APIs
- Higher risk & regulatory scrutiny (AML, KYC, etc.) requires deep expertise → highly specialized service providers, amalgamated plug-and-play model (analogy: AWS)

Technology in Finance: Near Term

- Underbanked & non-banked (incl. emerging countries)
- Cost of funding is still an issue (best is still depository)
- Data is a key factor (becoming third fundamental pillar with Labor and Capital)
- In any organization, better ideas OR better people?

Technology in Finance: Near Term

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- In any organization, better ideas OR better people?
- Better Data OR better algorithms?

Technology in Finance: Near Term

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- Data is a key factor (becoming third fundamental pillar with Labor and Capital)
- In any organization, better ideas OR better people?
- Better Data OR better algorithms?
- COVID-19 making shortcomings lot more visible

How Does Household Spending Respond to an Epidemic? Consumption During the 2020 COVID-19 Pandemic

Baker, Farrokhnia et al. (April 2020)

Income, Liquidity, and the Consumption Response to the 2020 Economic Stimulus Payments

Baker, Farrokhnia et al. (May 2020)

Technology in Finance: What's on the Horizon

- Fintech is everywhere! Most likely scenarios:
  - Algo/Quant trading > 50% of trading volume
  - Banking interactions is primarily mobile-first
  - Insurance is customizable, even at micro level
  - Payments are digital (cashless vs. less cash society)
  - Automation is best (personal finance, cash mgmt, etc.)
  - Data, data, data … empirical, behavioral & more


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A few words on Data & Data Analytics Process

- What is the biggest gap in your organization impeding the use of data for smarter decision making?
  - Defining Problem + Formulating Questions
  - Data Discovery
  - Data Analysis
  - Insight Delivery
  - Solution Implementation (i.e., Execution)

A few words on Data & Data Analytics Process

- What is the biggest gap in your organization impeding the use of data for smarter decision making?
  - **Defining Problem + Formulating Questions**
  - Data Discovery
  - Data Analysis
  - Insight Delivery
  - Solution Implementation (i.e., Execution)

Email!

In-class exercise (individual + group)


ARTIFICIAL
INTELLIGENCE

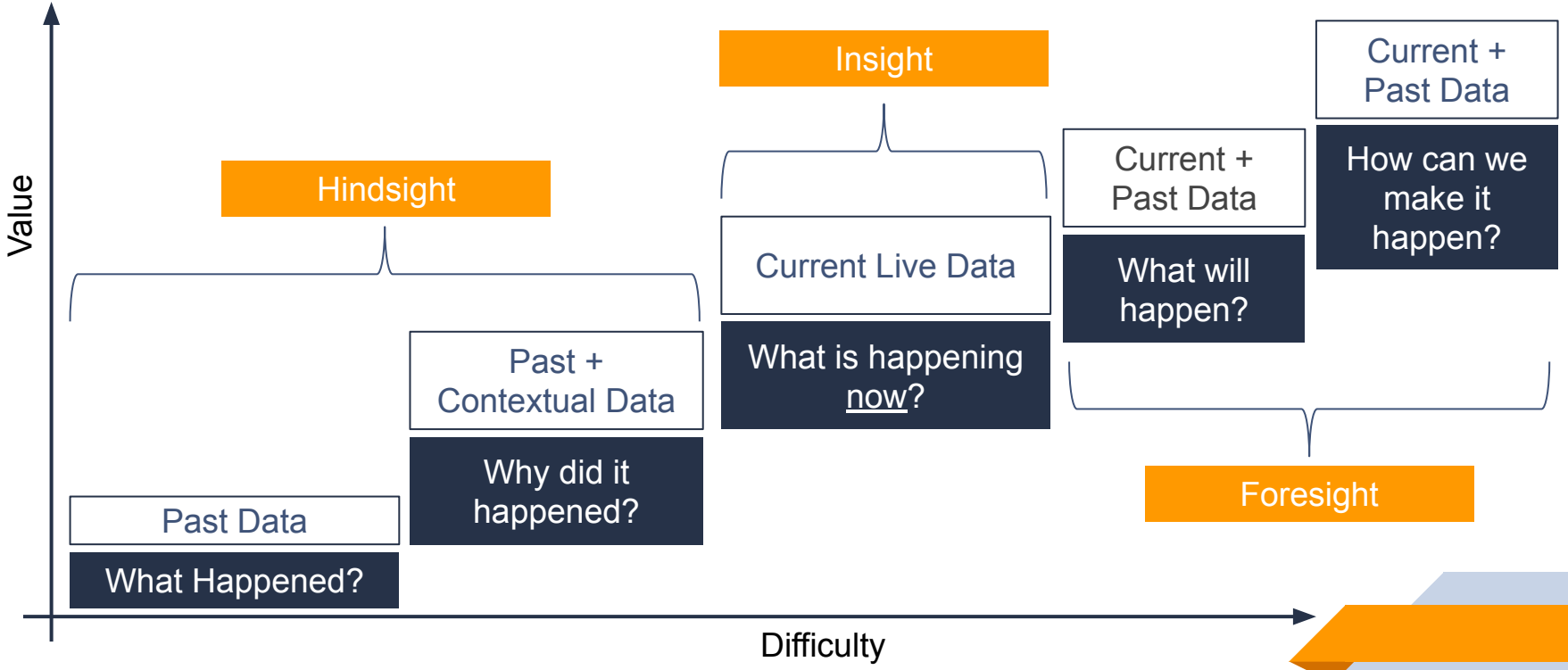
Technology in Finance: Longer Term Outlook

- Machine Learning & Artificial Intelligence (ML/AI)
- “Software is eating the world”
- What is AI? ...

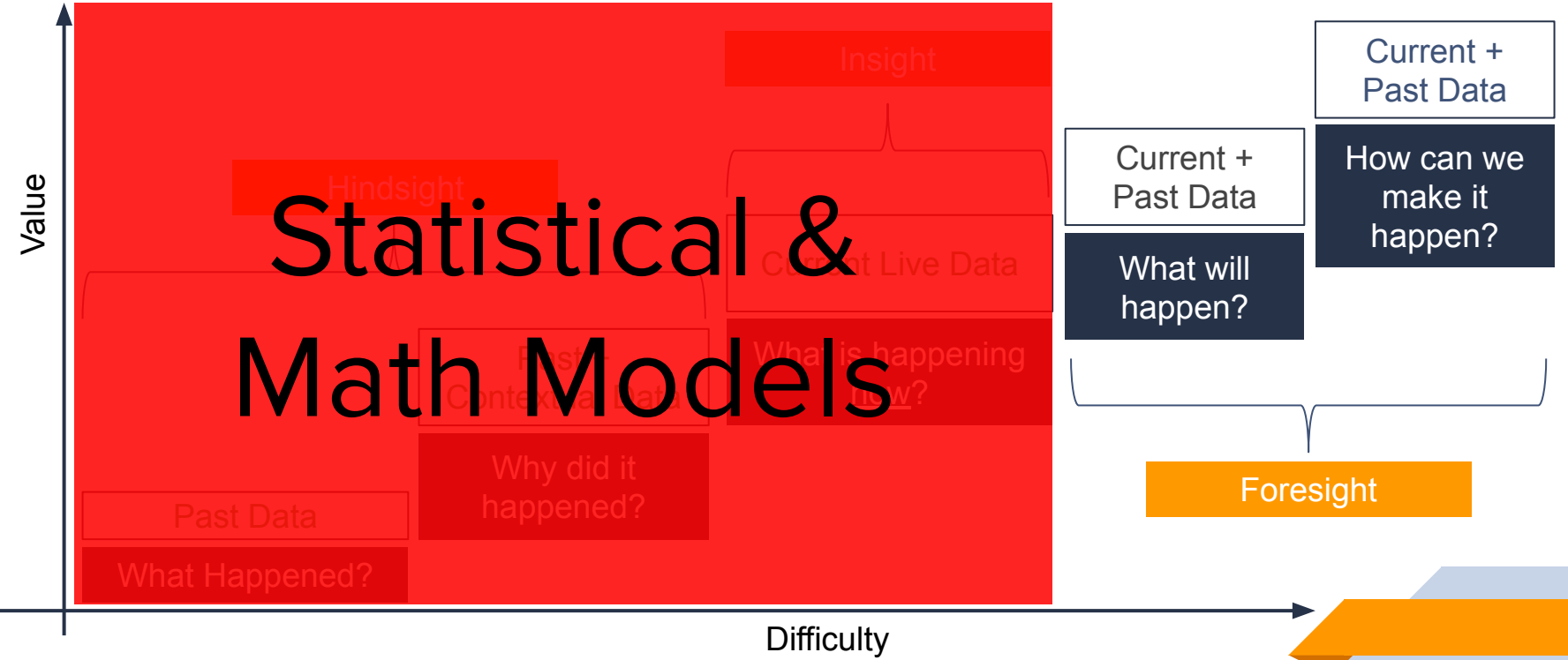
Technology in Finance: Longer Term Outlook

- Machine Learning & Artificial Intelligence (ML/AI)
- “Software is eating the world”
- What is AI? ...
  - … “Human Intelligence exhibited by machines”

Evolution in Data Usage & Value



Evolution in Data Usage & Value



Statistical & Math Models

Current + Past Data

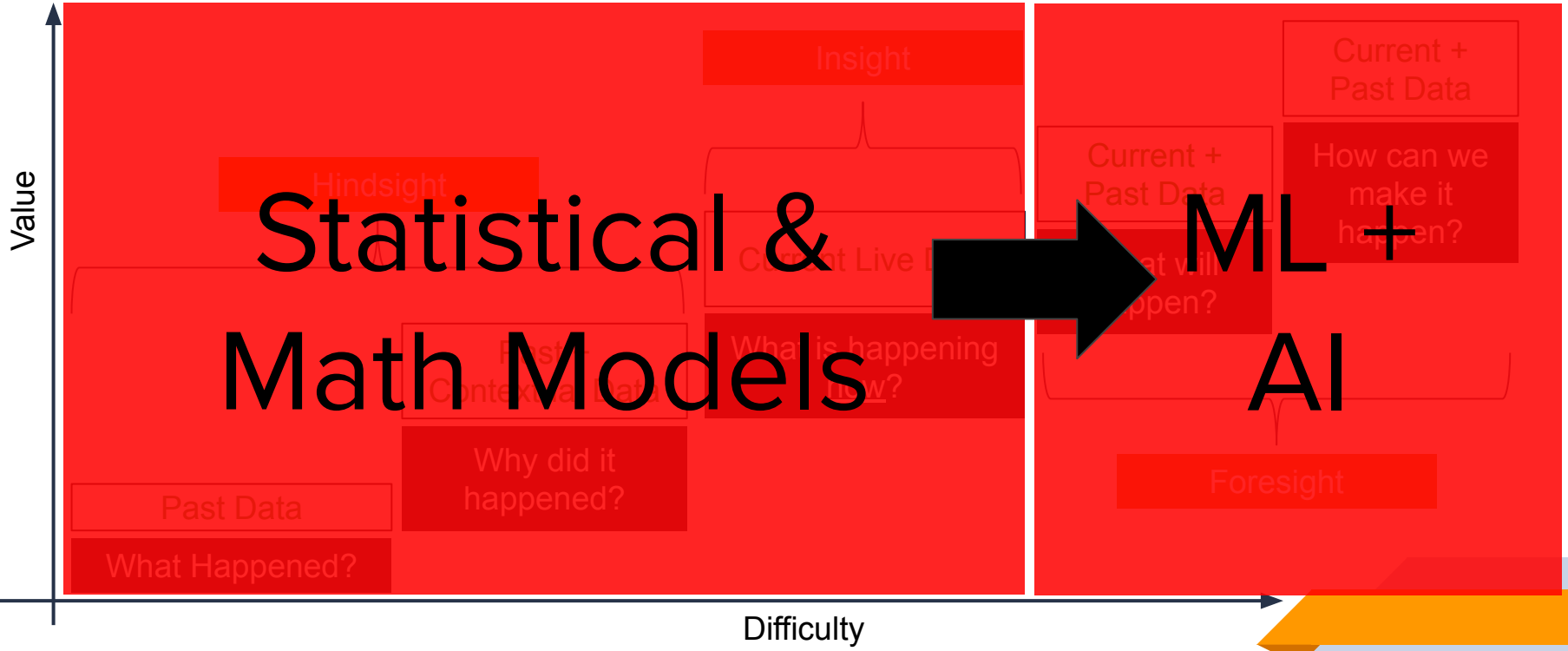
How can we make it happen?

Current + Past Data

What will happen?

Foresight

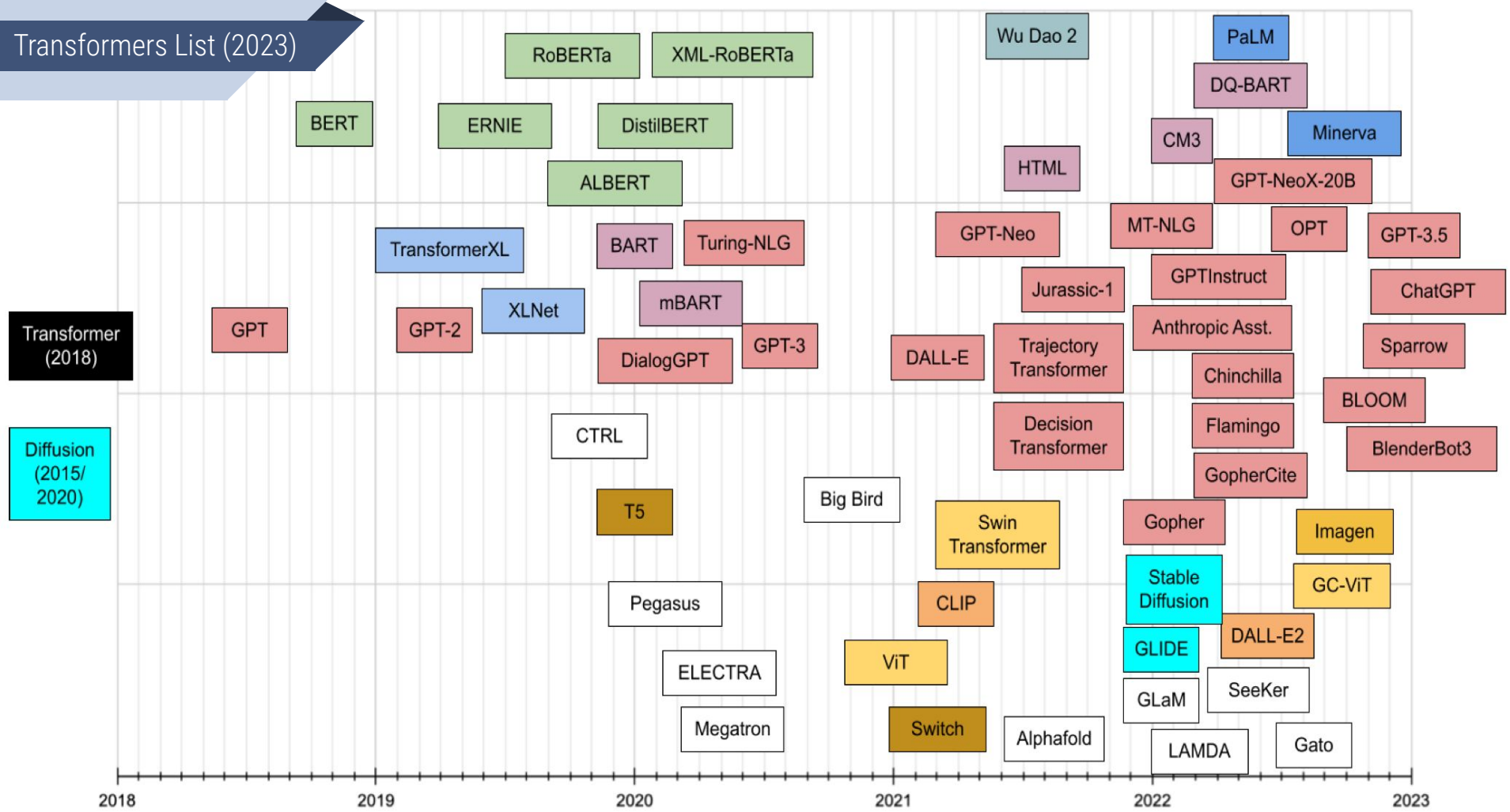
Evolution in Data Usage & Value



Technology in Finance: Longer Term Outlook

- What is AI? ...
  - … “Human Intelligence exhibited by machines”
- Narrow AI vs. General AI
- Moravec’s Paradox ⟶ Transformers, Generative AI, Diffusion Models

Transformers List (2023)



Source: Xavier Amatriain

Technology in Finance: Longer Term Outlook

- What is AI? ...
  - … “Human Intelligence exhibited by machines”
- Narrow AI vs. General AI
- Moravec’s Paradox ⟶ Transformers/G-AI/Diff. Models
- What is the TRUE “AI Strategy” of most companies?!
- Data fuels ML/AI models in various forms/levels (data > algos)
- Bias, concentration, hardware (data center, GPU, etc.)


BLOCKCHAIN

Technology in Finance: Longer Term

- Blockchain is amongst the most promising innovations
- Decentralized, Distributed + Open, Permission Protocols
- Programmable money, smart contracts, DeFi, new governance structures (automation), sovereign coin
- U.S. vs. Europe vs. Asia (and China; Alipay, WeChat, etc.)
- Regulatory arbitrage
- Infrastructure as a Service

Market Dynamics: a few more points to consider

- Changing demographics → habits & engagement with Fin Services across the board (esp for younger generations)
- Example: new phenomena enabled by tech (e.g., meme stock)
- Compression of fees →

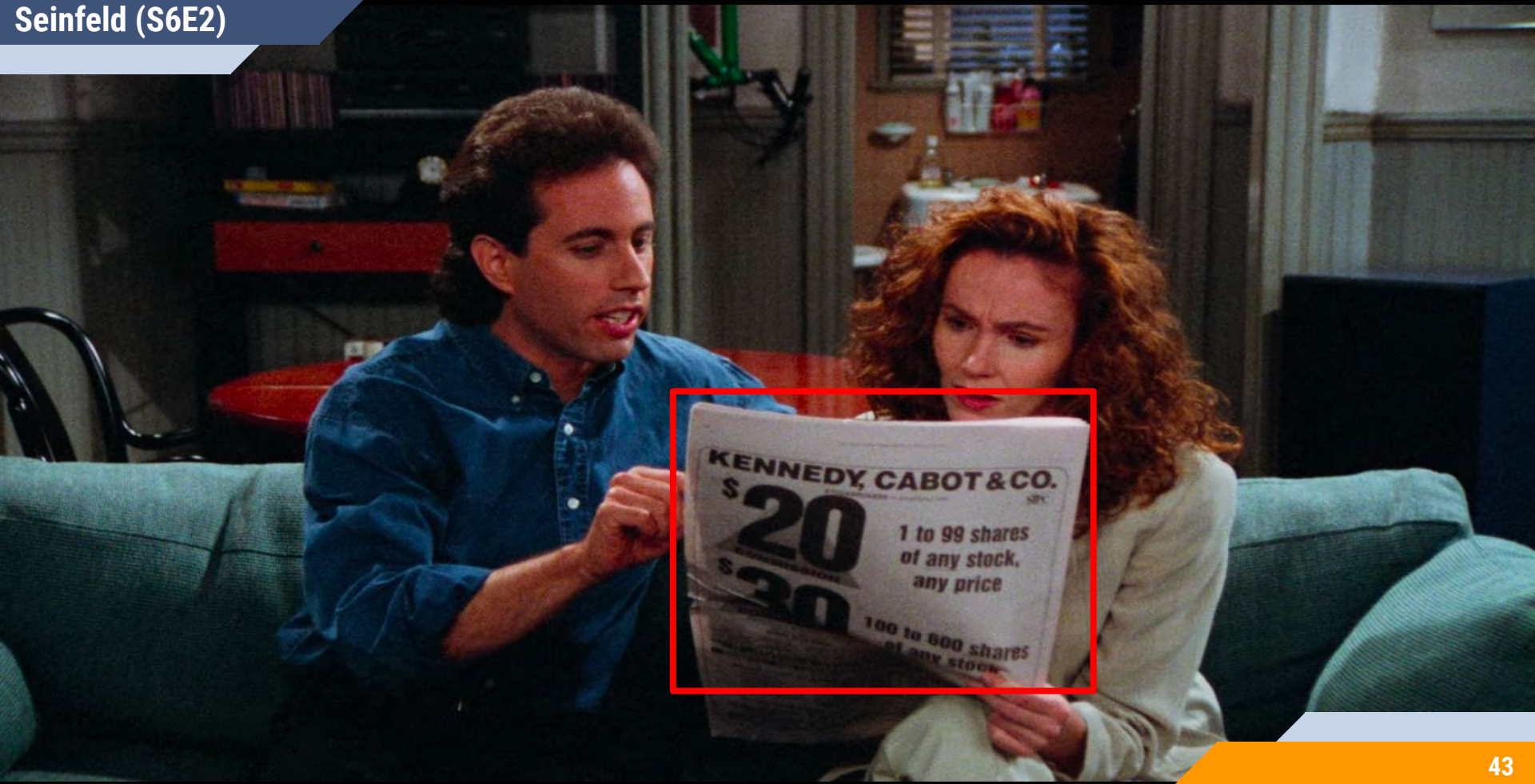
Seinfeld

Season 6, Episode 2: “The Big Salad”

Aired Sept. 29, 1994

Seinfeld (S6E2)

Seinfeld (S6E2)



Robinhood Dec 2014

Robinhood

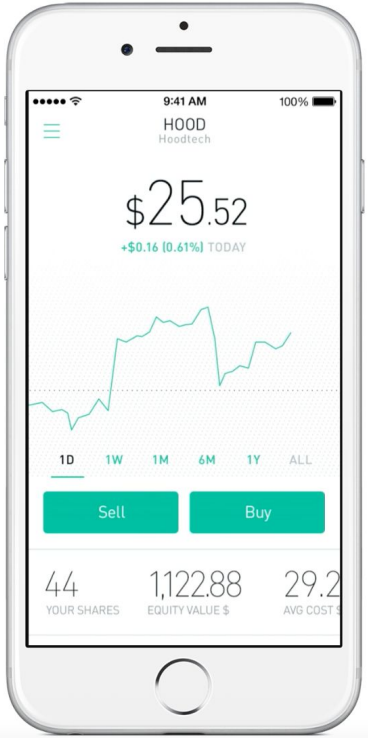
Zero commission stock trading. Stop paying up to $10 for every trade.

Enter email address

Get Early Access

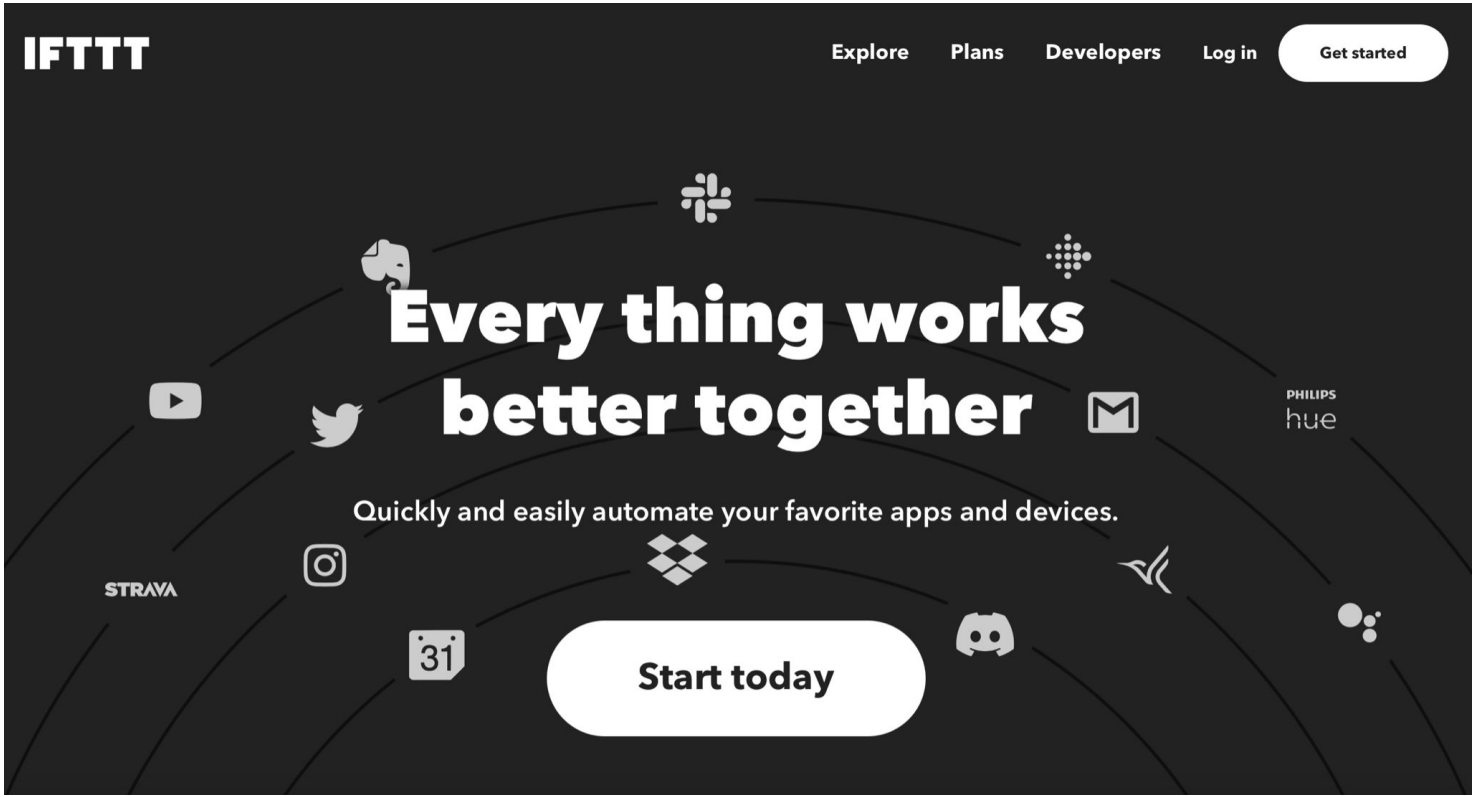
Watch Video

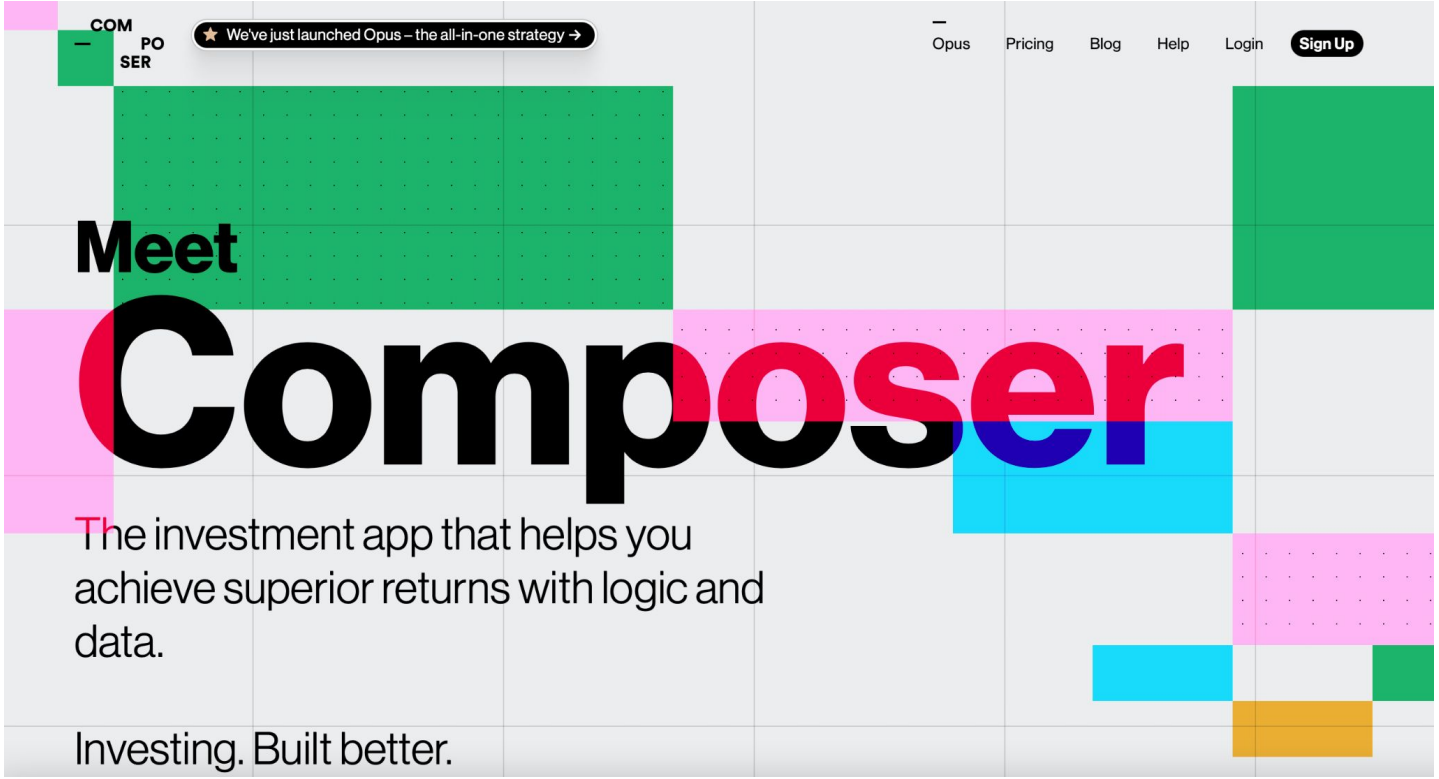
Download on the App Store



Market Dynamics

- Changing demographics → habits & engagement with Fin Services across the board (incl. payments & managing assets)
- Example: new phenomena enabled by tech (e.g., meme stock)
- Compression of fees
- Move toward more self-directed (Robinhood, Robos, Target Date Funds, etc.) + more “active self-directed” →


IFTTT
Explore
Plans
Developers
Log in
Get started
Every thing works better together
Quickly and easily automate your favorite apps and devices.
Start today
PHILIPS
hue
STRAVA
31

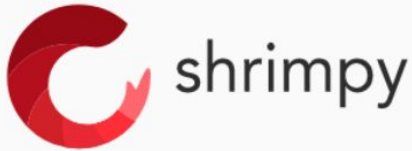

COM
PO
SER
We've just launched Opus – the all-in-one strategy →
Opus
Pricing
Blog
Help
Login
Sign Up
Meet
Composer
The investment app that helps you achieve superior returns with logic and data.
Investing. Built better.

Demo


CRYPTO
HOPPER


COINRULE


Botsfolio


shrimpy

Market Dynamics

- Changing demographics → habits & engagement with Fin Services across the board (incl. managing assets)
- Example: new phenomena enabled by tech (e.g., meme stock)
- Compression of fees
- Move toward more self-directed (Robinhood, Robos, Target Date Funds, etc.) + more “active self-directed” →
- Alternatives to traditional financial services models →

“Finfluencers”

Financial guidance through social media?

The New York Times

From Her First $100K to 3 Million Followers

Tori Dunlap's savings journey turned her into a full-time finfluencer. Her latest partnership aims to help women get together and get started with investing.

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Technology in Finance: The Now

- Regulation is key and is evolving (although slowly)
- More capabilities added to online banking (not just for checking balances!), with more continuously added …
- … not to mention new applications from startups in all domains
- Trust still important … but big banks are no longer the only sources (next-gen consumers open to new products and service providers from startups and the like)
- The fast change of pace in today's world

About the Future

“The future is already here – it's just not evenly distributed.”

William Gibson, American-Canadian Author

> *A 90-min presentation demonstrating almost all the fundamental elements of networked digital communication: mouse, hypertext & hyperlinks, screen sharing, graphics, efficient navigation and command input,* ***live video conferencing****, dynamic file linking, revision control, and a collaborative* ***real-time*** *editing (shared doc), among others.*

Dec 8, 1968!!

The Mother of All Demos! Isn't that AMAZING?!

2A3 BANANAS
2A4 CARROTS
2A5 LETTUCE
2A6 BEANS
2B CANS #
2C CEREALS
2D COLD LOCKER
2E FROZEN LOCKER
2F MISCELLANEOUS
3 SHOE STORE
4 HARDWARE
5 ART SUPPLY
6 DRUG STORE
7 LIBRARY

Evolution of Fintech

Part 2

Decentralized Finance

A complete rethinking of Financial Services through Blockchain

What is DeFi?

What is it? How is it different from “classic” finance? Why should I know about it?

DeFi: Intro & Core Concepts

- A (potentially) powerful new paradigm in financial services in which everything happens in an automated fashion on a decentralized blockchain … and Web3.0 applications
- Very new (gained super speed in summer 2020), data-rich, complex, still speculative, still high risk
- Discerning real possibilities from pitfalls still requires deep due-diligence and technical capabilities … but not impossible!
- DeFi does not exclusively involve financial instruments!

DeFi: Intro & Core Concepts

- Decentralized - no single point of failure, no single source of truth, and no single authority capable of or responsible for making changes to data or to prevent transactions
- Traditional financial services activities such as trading, lending, deposit-taking, custody but with any type of crypto-asset and fully decentralized (as mentioned!)
- Extension of the current trend in Fintech towards greater automation leveraging continuous advances in computing, data generation and analyses, and global connectivity

DeFi: How things are going in 2022 :-(

- Collapse of Terra/Luna, Celsius Networks, 3 Arrows Capital, FTX, etc. (with a mess of a bankruptcy proceedings!)
- Yields too good to be true … turned out to be too good!
- Cascade and Contagion effects
- Fraud and scams in Crypto (into billions of dollars and millions of customers)
- Bitcoin at around $23,000 (or less!) - any significance to it?
- Where we go from here? Is DeFi dead?

Examples

A few theoretical case-studies …
with a reality check of 2023!

Example 1: Gaming

Use of tokens outside of the game metaverse!

Example 2: Insurance

Deconstructing & distributing risk/rewards

Example 3: Lending

Open-lending platforms without central authority

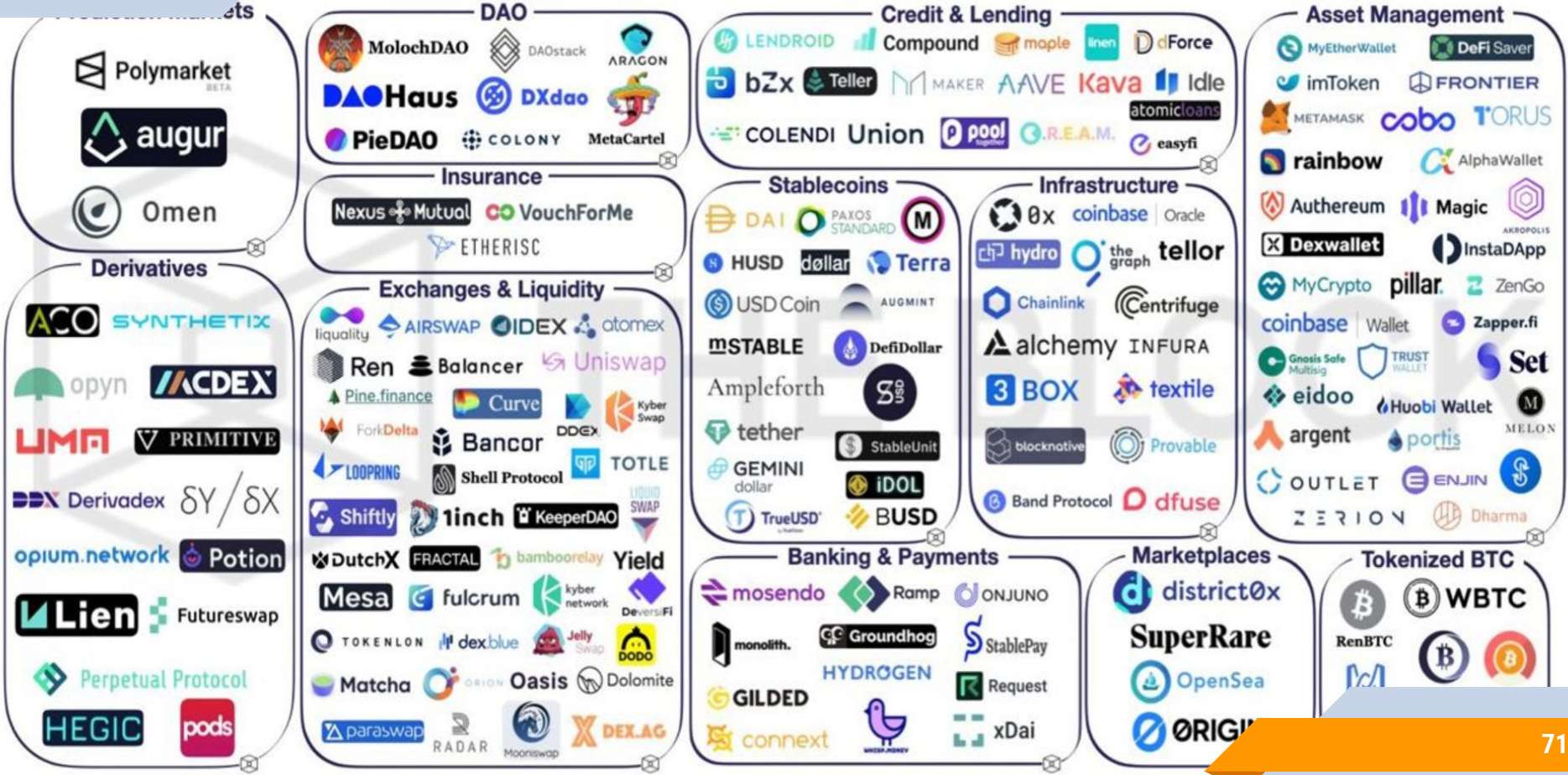
DeFi-nition!!

Now let’s come up with a standard definition

> *Take the traditional financial services, distill them into their component rules and processes, and convert them into self-executing code on decentralized networks accessible to anyone with a computer and internet connection.*
>
> *Jake Chervinsky (Compound) & Lee Schneider (Ava Labs)*

DeFi ecosystem on Ethereum

THE BLOCK



Some of the Relevant & the Irrelevant Factors

Relevant

Code

Code is Law/King/Queen :-)

Automation

Immutability alongside Automation are key

Open-Source

Wisdom of the Crowd, with mix & match capabilities

Irrelevant

Intermediaries

Who needs them?!

Asset Types

DeFi is agnostic about crypto-asset type - can handle all!

Physical Location

Just an internet connection is enough; can tokenize all!

Our Focus

Emergent/Real DeFi

Bona-fide DeFi or on the way to be

Pseudo DeFi

Has elements of DeFi, but not fully

Not DeFi!

Just masquerading as DeFi!

A Few Final Thoughts on DeFi

- DeFi done right could upend and vastly reduce the cost of financial services in general, could increase financial inclusion, and be good for the world (e.g., think remittances)
- Understanding a platform starts with scrutiny of its functions and features; they are key to determining utilization, valuation, legal classification, and regulation
- Doing due-diligence on a platform starts with scrutiny of its code for security, efficiency, transparency and interoperability, among others

A Few Final Thoughts on DeFi

- DeFi is “non-custodial” (in traditional sense) because no intermediary can withhold your assets - they are locked in a self-executing smart contract (a purist’s definition)
- DeFi does not mean ungoverned because there can be governance tokens and a voting mechanism for amendments, changes, etc.
- DeFi could unlock value and create tradable security for tokenized physical goods as well as virtual

A few words on NFTs

- **Non-Fungible Tokens** (NFTs)… but let's first define it →

AND TABLES TO COMPARE DATA

	Fungible	Non-Fungible
Uniformity	All $1 are uniform	Works of art are unique
Interchangeability	You can change $1 for any other $1 bill	Cannot change a Columbia diploma for another
Divisibility	One $1 bill is exactly equivalent to 4 quarters coins	Cannot get half a BA/BS degree by attending 2 years
Transferability	Any $1 bill can be given to whomever you choose	Your diploma is unique to you

Possible Opportunities to Generate Returns

- **Non-Fungible Tokens** (NFTs): current platforms require fungible tokens, but we are seeing NFTs in DeFi since the opportunity to diversify is too tempting and holders of NFTs want to realize value in all the ways DeFi provides

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- **Non-Fungible Tokens** (NFTs): current platforms require fungible tokens, but we are seeing NFTs in DeFi since the opportunity to diversify is too tempting and holders of NFTs want to realize value in all the ways DeFi provides
- **The Metaverse** … but let's first define it ⟶ Metaverse is the preferred term for the concept of a virtual shared space that could or does converges with actual reality (primary in gaming these days)

Possible Opportunities to Generate Returns

- **The Metaverse**: as gaming continues to grow and starts to use tokenization to create both fungible and non-fungible tokens, in-game items will provide an important source of assets for DeFi. Gaming platforms will link with DeFi platforms to facilitate new commercial experiences for those in their game world and attract those in DeFi to their game. Metaverse will then spring into a full economy, or perhaps create it own digital ecosystems that function completely outside the traditional economies by leveraging code, automation, immutability and composability.

Some of the Current Challenges

- **Laws and Regulations**: questions about definitions, developer liability, and legal status and enforceability of code (esp if “Code is the Law”), autonomous execution and immutability combined with how existing regulations apply to platforms: Will KYC/AML/CFT undermine DeFi?
- **Trust**: smart contract (including algorithm) are technically complex, and hackings risk could lead to real economic risk/downside. How due diligence will look like and include?

Some of the Current Challenges

- **Governance**: how to amend and make changes to the code, expand the capabilities, fend off hacks and attacks, spread the wealth. What is the mechanism for change (control)?
- **Valuation**: lacking precedent and models at several levels including platform, pool and individual transaction level. How will transaction or investment decisions be made?
- **Fiat access**: availability of fiat on/off ramps to/from platforms. Does DeFi require CeFi to fulfill its promise?!

Some of the Current Challenges

- **Scalability**: user interface, capacity for massive volumes/value of assets, high per transaction costs. Is DeFi just meant for sophisticated users and those with high tolerance for risk?
- **Credit**: lack of underwriting standards and credit worthiness metrics (may be unnecessary if it's "secured" lending!). Why must DeFi over-collateralize, and will it be always required?
- **All the other Unknowns**: self-explanatory!!

Part 3

Innovation Models & Roadmaps

Three years of research into some of the most innovative companies

Remember me?!

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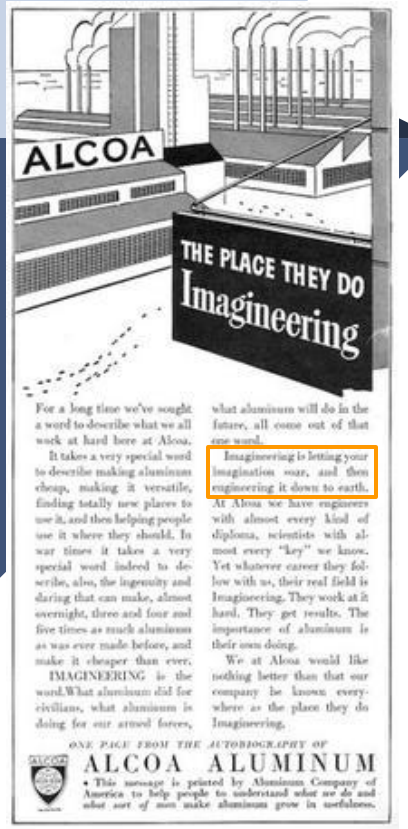
Did Someone Say “Imagineering?”

What is it that encapsulated the best of innovative companies & practices?

Imagineering is letting your imagination soar, and then engineering it down to earth.

Alcoa Ad, Time Magazine, Feb. 1942

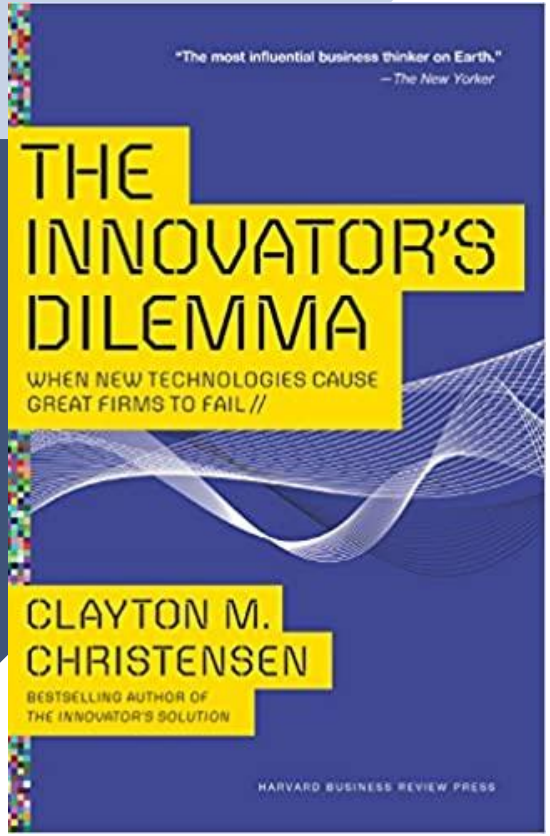


“

Disruptive Innovation: why and how big companies fail; codifying how innovation becomes sustainable

Clayton M. Christensen (Harvard)

”



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From Idea to Prototype in 5 Days; a model for iterative, lean, and agile product development (low/no code)

Jake Knapp et al. (Google Ventures)

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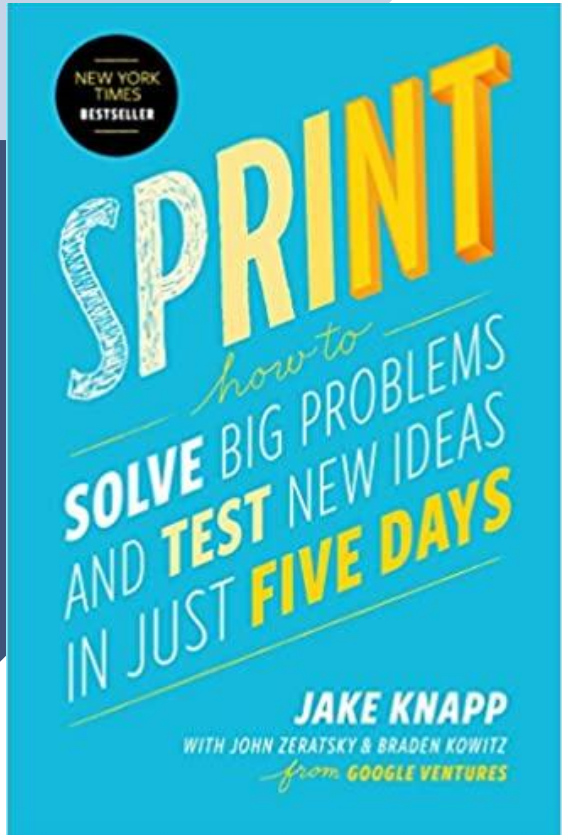
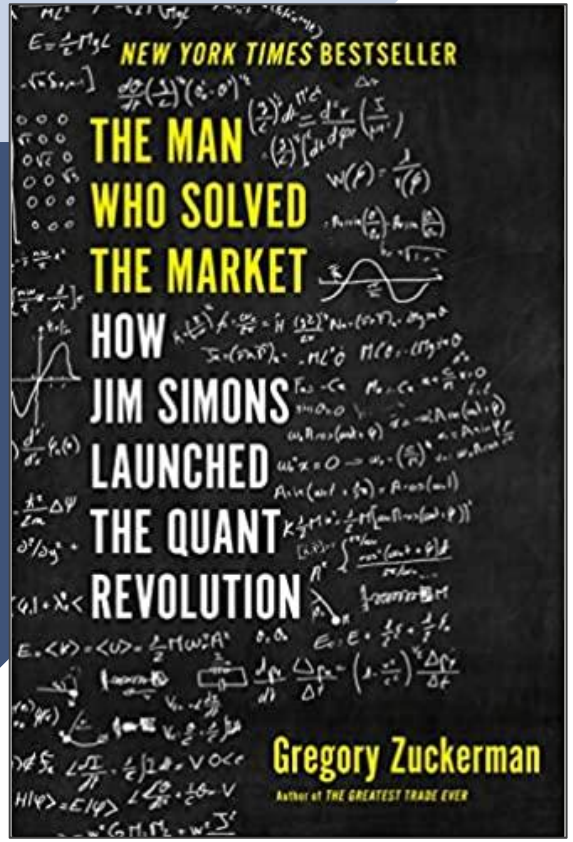


“The Man Who Solved the Market; the most successful quant fund manager, with annualized returns of ~40% net of fees over 30 years

Gregory Zuckerman (Wall Street Journal)”



Six Best Practices from Three Years of Research!

Talent

Identify and training best talent (not just those who test well! Google), inter-/multi-disciplinary, subjective AND objective, value of experimentation and play (Xerox PARC), import talent to fast track

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Fostering idea generation (Google vs. IDEO), low cost of prototyping, software (Silicon Valley), hardware (TUM in Germany), bring ideas into fun places, trust talent & let them play safely (Facebook, Netflix)

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Acting as a main hub to foster and empower research, inquiry, investigation, and spin-offs into startups (Stanford Model), with precise comp/equity upside protocols in place

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Investments

Hybrid Sovereign + VC fund (Singapore), global presence, strategic development + returns, professional GPs, longest-term view. Failure is inevitable; just make it accountable (NASA JPL)

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Hybrid Sovereign + VC fund (Singapore), global presence, strategic development + returns, professional GPs, longest-term view. Failure is inevitable; just make it accountable (NASA JPL)

Partnerships

Work with universities & industry, esp international, to develop core specialties, "riches in the niches," learning of best practices with incentives for partners (monetary or other)

Final Thoughts
+
Discussion
+
Q&A

Getting to the future a tad early?!

“The future is already here – it's just not evenly distributed.”

William Gibson, American-Canadian Author

Getting to the future a tad early?!

“We always overestimate the change that will occur in the next two years & underestimate the change that will occur in the next ten.”

Bill Gates

Thank You.

Any questions? Stay in touch.

Write me at fintech@gsb.columbia.edu

Visit fintech.gsb.columbia.edu