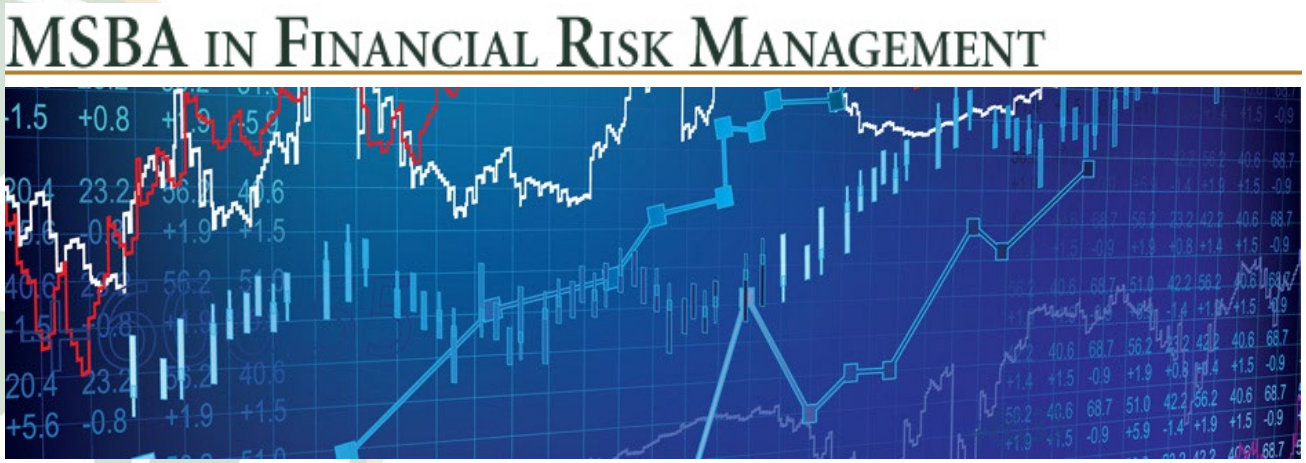
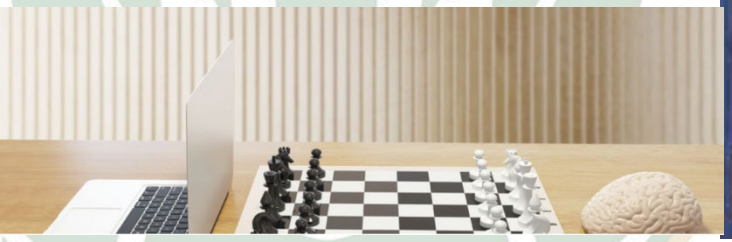
Financial Risk Management



Deep Learning

Deep Blue, An AI Milestone

- In 1997, the Deep Blue system of IBM defeated the world chess champion, Gary Kasparov. It was the first time that the world witnessed the historic event of a computer being worthy contender to one of the world's sharpest mind.



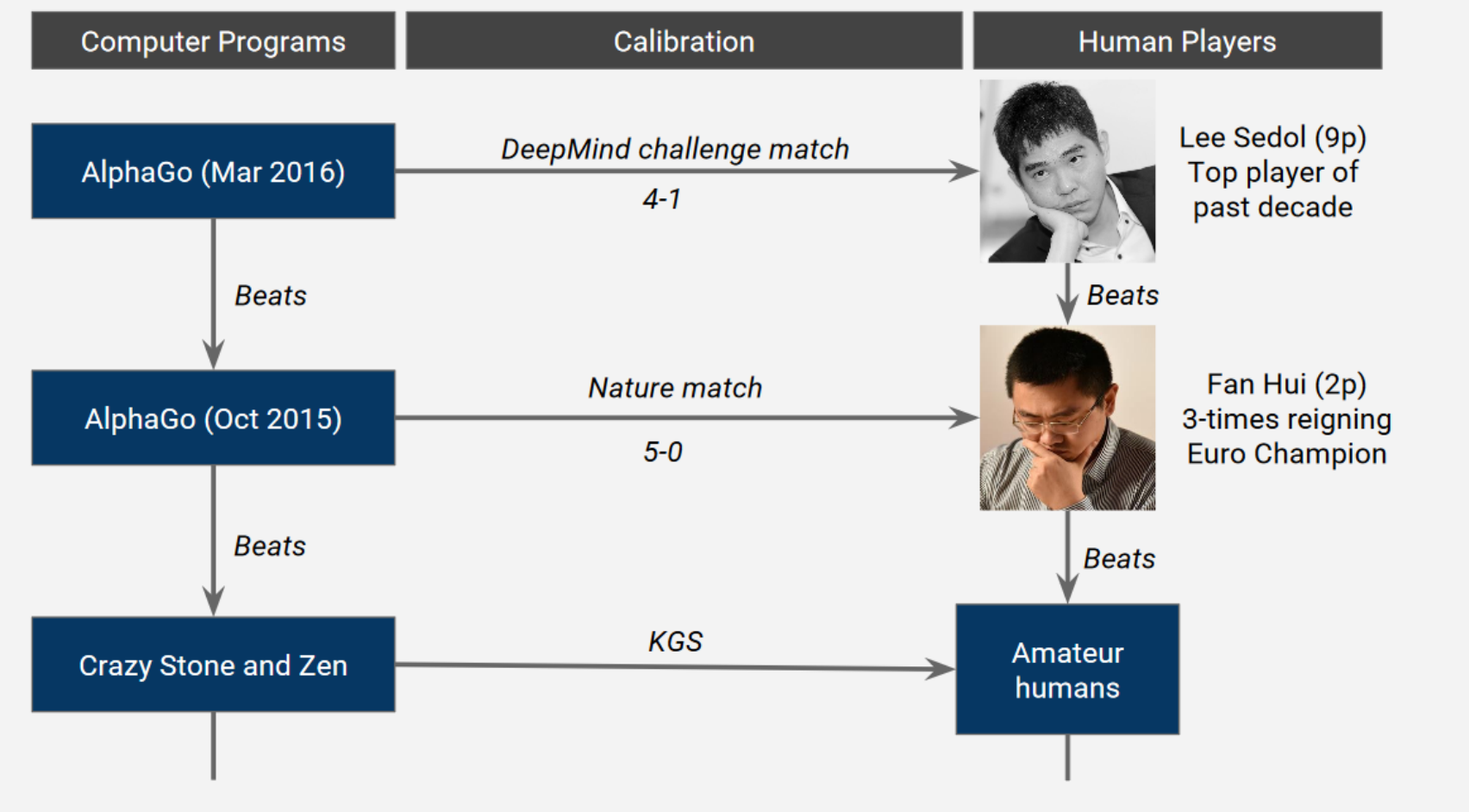
Let Computer Try Go

- Deep Blue simply used its advantage in high performance computing to calculate millions calculations in a second. But, can we apply the same technique for Go? the answer is NO.
- The reason is Go is a game of profound complexity. The possible positions of Go is more than a googol (10^100) times larger than in chess.

Deep Learning

- Traditional AI methods, which construct a search tree over all possible positions, don't have a chance in Go
- Monte Carlo tree search algorithms tried a new approach to evaluation based on a clever way of randomly simulating games.
- AlphaGo uses deep leaning and neural networks to essentially teach itself to play. AlphaGo's intelligence is based on its ability to learn from millions of Go positions and moves from human-played games.

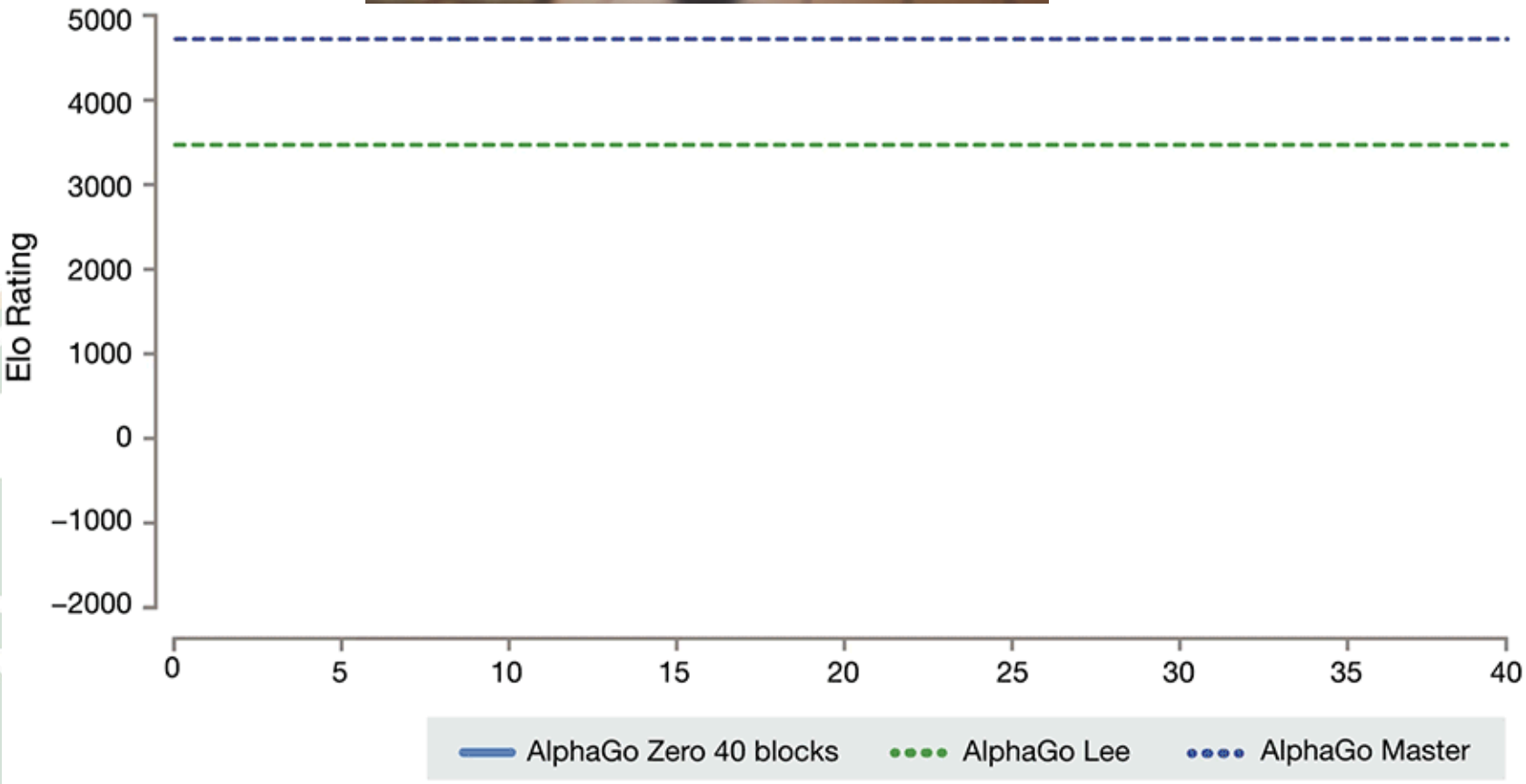
From Nobody to Number 2



Number 1 in the World

- A little over one year later, AlphaGo again competed in a high-profile match, this time against the world's top Go player, a 19-year-old prodigy named Ke Jie.
- The machine shut the human out, three games to none. With these victories under its belt, Google announced in May that it would retire AlphaGo.
- But it appears that it had just one more Go-related challenge to conquer…

AlphaGo Zero
Starting from scratch


Elo Rating
5000
4000
3000
2000
1000
0
−1000
−2000
0
5
10
15
20
25
30
35
40
AlphaGo Zero 40 blocks
AlphaGo Lee
AlphaGo Master

Reinforcement Learning

- It is able to do this by using a novel form of reinforcement learning, in which AlphaGo Zero becomes its own teacher.
- The system starts off with a neural network that knows nothing about the game of Go. It then plays games against itself, by combining this neural network with a powerful search algorithm. As it plays, the neural network is tuned and updated to predict moves, as well as the eventual winner of the games.
- This technique is more powerful than previous versions of AlphaGo because it is no longer constrained by the limits of human knowledge.

High Frequency Trading

What is High-Frequency Trading?

- Trading, not investing
- Start holding no positions
- Finish holding no positions
- Buy/Sell millions of shares during the day
- Move into and out of a position in minutes, seconds, even milliseconds
- Microseconds soon
- NASDAQ will respond in ~100 nanoseconds after an order hits its machines

What is High-Frequency Trading?

- there is no legal definition of high frequency trading, the Securities and Exchange Commission (SEC) has set forth five trading characteristics common to this practice:
  - Use of extraordinarily high speed and sophisticated programs for generating, routing, and executing orders.
  - Use of co-location services and individual data feeds offered by exchanges and others to minimize network and other latencies.
  - Very short time-frames for establishing and liquidating positions.
  - Submission of numerous orders that are cancelled shortly after submission.
  - Ending the trading day in as close to a flat position as possible (that is, not carrying significant, unhedged positions overnight).

High-Frequency Trading

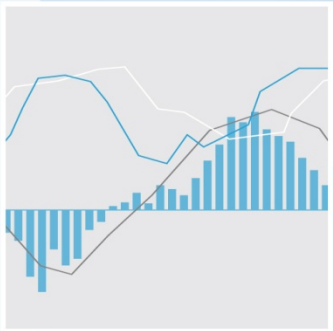
- High-frequency trading became popular when exchanges started to offer incentives for companies to add liquidity to the market.
- For instance, the New York Stock Exchange (NYSE) has a group of liquidity providers called Supplemental Liquidity Providers (SLPs) that attempts to add competition and liquidity for existing quotes on the exchange.
- As an incentive to companies, the NYSE pays a fee or rebate for providing said liquidity. In July 2016, the average SLP rebate was $0.0019 for NYSE- and NYSE MKT-listed securities on NYSE.
- With millions of transactions per day, this results in a large amount of profits. The SLP was introduced following the collapse of Lehman Brothers in 2008, when liquidity was a major concern for investors.

High-Frequency Trading

- HFT is complex algorithmic trading in which large numbers of orders are executed within seconds.
- It adds liquidity to the markets and eliminates small bid-ask spreads.
- High frequency traders can conduct trades in approximately one 64 millionth of a second. This is roughly the time it takes for a computer to process an order and send it out to another machine. Their automated systems allow them to scan markets for information and respond faster and than a human possibly could.
- They complete trades in the time it would take for a human brain to process the new data appearing on a screen (no less physically enter new trade commands into their system).

High-Frequency Trading

- Algorithmic trading is a method of trading widely used across the market: the algorithm executes pre-programmed trading instructions, making decisions based on variables including the timing, price, or quantity of the order.
- HFT is a type of algorithmic trading, where participants use low latency technologies, such as co-location and direct connections to the exchange, and consequently a high messaging frequency. This technology also allows traders to send regular order updates to manage their risk: a useful addition to any trading strategy.
  Like algorithmic trading, high frequency technologies are used across all three categories of market participant (buy side, sell side and market makers).

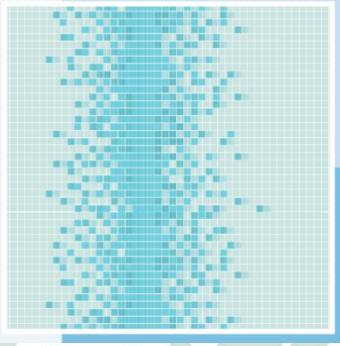


ALGORITHMIC TRADING
(FROM EARLY 90s)

Algorithmic trading uses computer software programs to calculate the price, timing, quantity and other characteristics of orders, which manual traders can authorize in part or in groups of orders. Not all algorithmic trading is automated as the actual placement of orders can still be done manually using the information produced by algorithmic software.

AUTOMATED TRADING
(FROM LATE 90s)

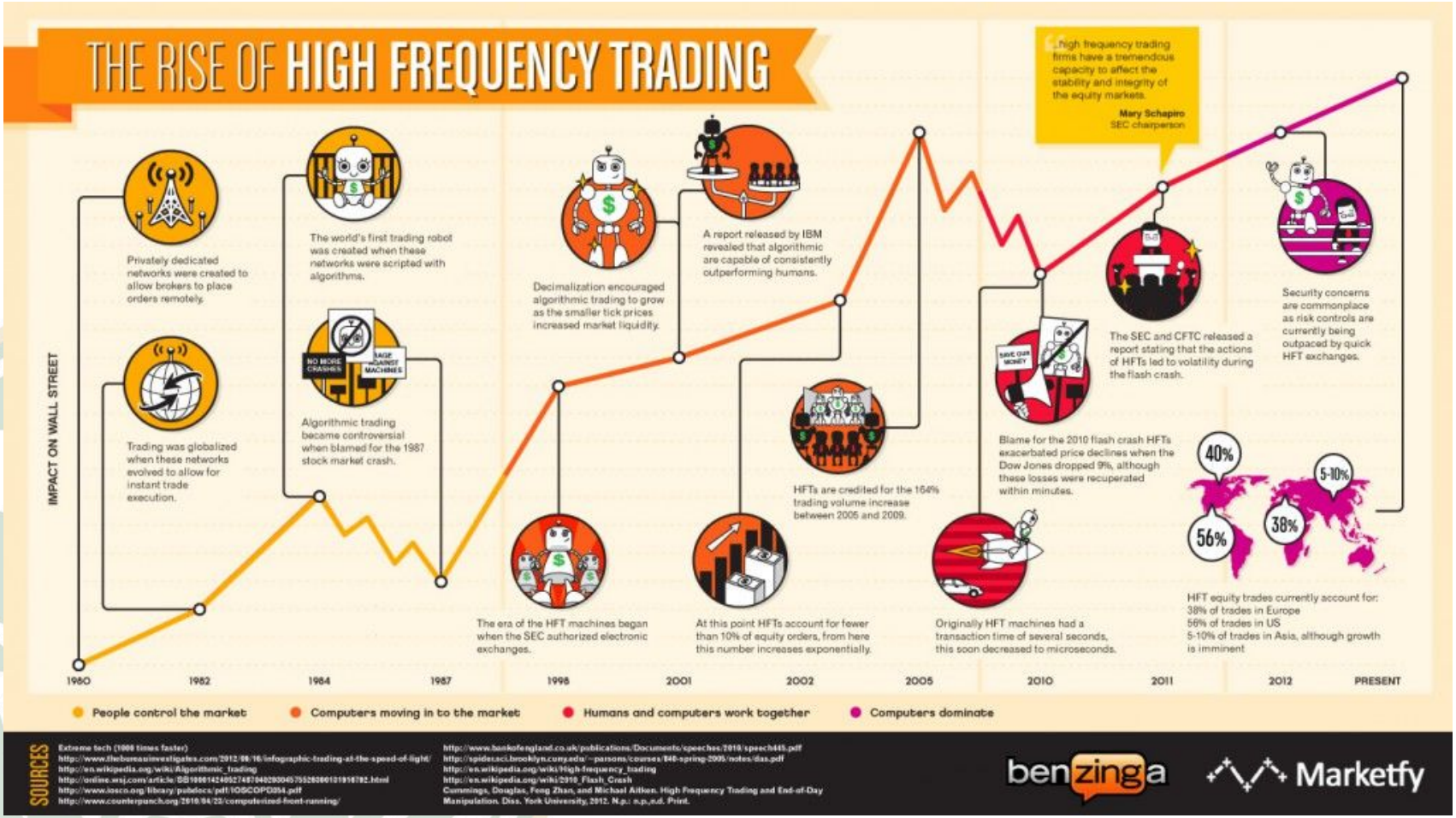
A method of trading where computer software is used to fully automate order generation. Computers are linked to market data, which is fed into algorithms, and then automatically place orders in the market. Although the systems trade by themselves, they are controlled by both a risk manager and commands within the software.



HIGH FREQUENCY TRADING
(FROM 2000s)

High Frequency Trading (aka. HFT) is a general term referring to a form of algorithmic trading which occurs at a rate of action only computers can maintain. Best characterized by the sophisticated technology required to minimize response times, such as powerful computers with direct network connections to exchanges (including co-location).

https://epta.fia.org/articles/high-frequency-trading-or-high-frequency-technology


THE RISE OF HIGH FREQUENCY TRADING
IMPACT ON WALL STREET
Privately dedicated networks were created to allow brokers to place orders remotely.
Trading was globalized when these networks evolved to allow for instant trade execution.
The world's first trading robot was created when these networks were scripted with algorithms.
NO MORE CRASHES
RAGE AGAINST MACHINES
Algorithmic trading became controversial when blamed for the 1987 stock market crash.
Decimalization encouraged algorithmic trading to grow as the smaller tick prices increased market liquidity.
A report released by IBM revealed that algorithmic are capable of consistently outperforming humans.
The era of the HFT machines began when the SEC authorized electronic exchanges.
At this point HFTs account for fewer than 10% of equity orders, from here this number increases exponentially.
HFTs are credited for the 164% trading volume increase between 2005 and 2009.
Originally HFT machines had a transaction time of several seconds, this soon decreased to microseconds.
SAVE OUR MONEY
Blame for the 2010 flash crash HFTs exacerbated price declines when the Dow Jones dropped 9%, although these losses were recuperated within minutes.
"high frequency trading firms have a tremendous capacity to affect the stability and integrity of the equity markets."
Mary Schapiro
SEC chairperson
The SEC and CFTC released a report stating that the actions of HFTs led to volatility during the flash crash.
Security concerns are commonplace as risk controls are currently being outpaced by quick HFT exchanges.
40%
56%
38%
5-10%
HFT equity trades currently account for:
38% of trades in Europe
56% of trades in US
5-10% of trades in Asia, although growth is imminent
1980
1982
1984
1987
1998
2001
2002
2005
2010
2011
2012
PRESENT
People control the market
Computers moving in to the market
Humans and computers work together
Computers dominate
SOURCES
Extreme tech (1000 times faster)
http://www.thebureauinvestigates.com/2012/08/16/infographic-trading-at-the-speed-of-light/
http://en.wikipedia.org/wiki/Algorithmic_trading
http://online.wsj.com/article/SB10001424052748704029304575528080101958782.html
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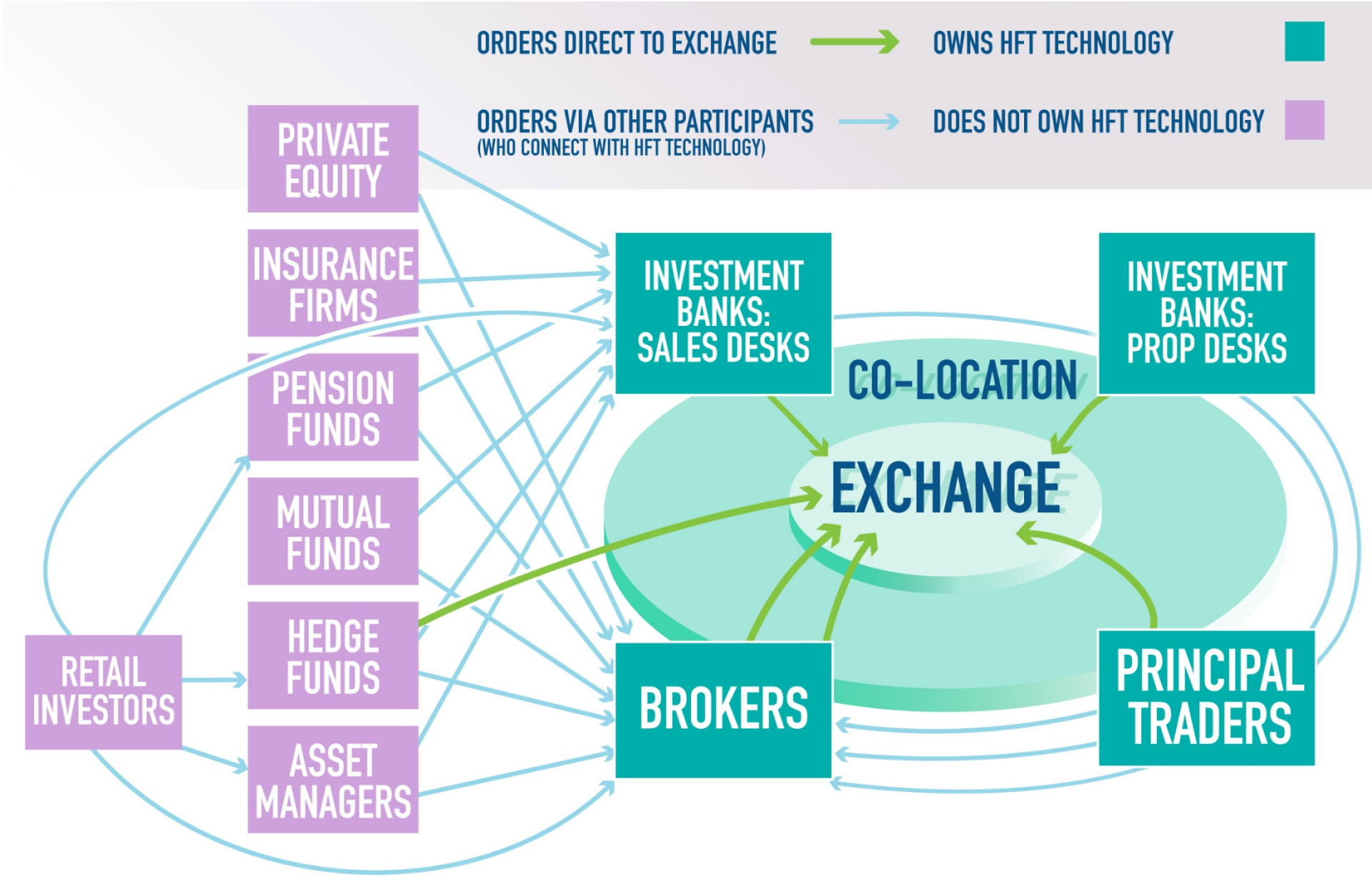
http://en.wikipedia.org/wiki/High-frequency_trading
http://en.wikipedia.org/wiki/2010_Flash_Crash
Cummings, Douglas, Feng Zhan, and Michael Aitken. High Frequency Trading and End-of-Day Manipulation. Diss. York University, 2012. N.p.: n.p.,n.d. Print.
benzinga
Marketfy


ORDERS DIRECT TO EXCHANGE
OWNS HFT TECHNOLOGY
ORDERS VIA OTHER PARTICIPANTS
(WHO CONNECT WITH HFT TECHNOLOGY)
DOES NOT OWN HFT TECHNOLOGY
PRIVATE EQUITY
INSURANCE FIRMS
PENSION FUNDS
MUTUAL FUNDS
HEDGE FUNDS
ASSET MANAGERS
RETAIL INVESTORS
INVESTMENT BANKS: SALES DESKS
INVESTMENT BANKS: PROP DESKS
CO-LOCATION
EXCHANGE
BROKERS
PRINCIPAL TRADERS

Volume Trading & Short Term Opportunities

- This system allows traders to profit off of a sheer number of trades that would be impractical or impossible for a manual trader. Through automation a high frequency trader can conduct enough trades in enough volume to profit off even the smallest differences of price.
- High frequency trading allows the investor to capitalize on opportunities that only exist for a short moment in the stock market. It also lets them be first to take advantage of those opportunities before prices have a chance to respond.
  - For example, say that a major investment firm liquidates one of its portfolios. Involved in this trade is approximately 1 million shares of Company X's stock. In this case, the price per share for Company X would likely decline for a short time while the market adjusted to the newly released stocks. This dip could last for minutes or even seconds; not long enough for most manual traders to take advantage of, but plenty of time for an algorithm to conduct numerous trades.

Arbitrage Opportunities

- Arbitrage is when you take advantage of the same asset having two different prices. In most real world trading situations arbitrage opportunities are difficult to come by. This is because the speed and reliability of global information networks means that most prices update in practically real time around the world.
- However "practically" is the watchword. High frequency trading can allow investors to take advantage of arbitrage opportunities that last for fractions of a second. For example, say it takes 0.5 seconds for the New York market to update its prices to match those in London. For half of a second, euros will sell for more in New York than they do in London. This is more than enough time for a computer to buy millions of dollars' worth of currency in one city and sell it for a profit in the other.

High-Frequency Trading

- There are two primary criticisms of HFT.
- The first one is that it allows institutional players to gain an upper hand in trading because they are able to trade in large blocks through the use of algorithms.
- The second criticism against HFT is that the liquidity produced by this type of trading is momentary. It disappears within seconds, making it impossible for traders to take advantage of it.

Peer to Peer Lending

Peer to Peer Lending

- Peer to peer or marketplace lending platforms
- lending to individuals or businesses through online services that match lenders directly with borrowers
- P2P lending is also known as social lending or crowdlending. It has only existed since 2005
- operation of lending platform may be regulated

Peer to Peer Lending

Top10.com

Top 10 | Reviews | Peer to Peer | Best Providers For... | Comparison | Learn

Best Peer to Peer Lending Companies

Find the right P2P loan for you from our list of partner brands, the leading providers on the market. Compare rates and terms, and apply now.

We receive referral fees from partners | How We Rank | Advertising Disclosure

Refine Results

Loan Amount $10,000
$500 — $100,000

Annual Income $50,000
$10,000 — $100,000

Credit Score
Good (690-719)

Reset Filters

Must Reads

The Best Personal Loans for Christmas 2020

1 credible
3,003 Reviews
On Trustpilot

Credible
Free to use, no hidden fees
- APR: 4.99% - 35.99%
- Loan Term: 24-84 months
- Credit Score: Fair/Good/Excellent

Over 1,130 people chose this site today
GET MY RATE
Read Review

2 lendingtree
7,654 Reviews
On Trustpilot

LendingTree
Banks compete, you enjoy low rates
- APR: 3.99% - 35.99%
- Loan Term: 3-180 months
- Credit Score: Poor/Fair/Good/Excellent

GET MY RATE
Read Review

3 LendingClub
641 Reviews
On Trustpilot

LendingClub
Apply anytime and get funds fast
- APR: 6.95% - 35.89% ***
- Loan Term: 36-60 months
- Credit Score: Fair/Good/Excellent

GET MY RATE
Read Review

Peer to Peer Lending

- P2P lending websites connect borrowers directly to investors. The site sets the rates and terms and enables the transaction.
- P2P lenders are individual investors who want to get a better return on their cash savings than a bank savings account or CD offers.
- P2P borrowers seek an alternative to traditional banks or a better rate than banks offer.
- Marketplace or “peer-to-peer” lending platforms make a profit from arrangement fees rather than the spread between lending and deposit rates
- Marketplace lending has grown due to low interest rates, low default rates, improved lending process and scarcity of consumer credit

Peer to Peer Lending

- Partnerships between banks and MPLs are becoming increasingly common in the US.
  - BBVA Compass bank, for example, partners with OnDeck to originate small business loans through the platform by referring customers for smaller loan amounts.
- Other bank partnerships focus on funding, i.e. rather than simply referring the loan on to an MPL, the bank provides the funding themselves.
  - For example, LendingClub and Citigroup announced a partnership in April 2015 in which Citigroup provides borrowers on the platform with funding through the Varadero Capital hedge fund, which takes on the first loss risk.
- These arrangements allow banks to provide funding to higher risk individuals, while passing much of the credit risk on to investors.

Peer to Peer Lending

- Peer-to-peer lending is controversial. An analysis by the Cleveland Federal Reserve in 2017 warned that consumer lending through peer-to-peer sites was beginning to resemble the subprime mortgage lending system that caused the 2008 financial crisis. That is, as the sites expanded their reach they began loosening their standards, leading to higher default rates.
- It also had a warning for consumers: People who consolidate consumer debt through peer-to-peer lending sites tend to wind up with even more overall debt when they begin to use credit cards freed up by their loans.

Colorado State University

FINANCIAL TIMES

ALPHAVILLE

KETS LIVE LONG ROOM ALPHACHAT

Big Data Peer-to-peer lending Online lending

How big data really fits into lending

"

New technology allows lenders to use machine learning algorithms that could make better use of lenders' data insights, searching volumes of data that human decisions cannot assess today. Future techniques will filter for new fields like education, academic scores, labour profile, job history and other professional skills which are out of the scope of current scoring systems.

Mobile Payments

Mobile Payments

- ✓ Figures show the largest usage of mobile payments are those who do not have a bank account (45%).
- ✓ Likely that those combining hardware and software, such as Apple Pay and Samsung Pay, will be the dominant players.
- ✓ The following factors might increase the use of mobile wallets:
  - more Global Mobile Wallet Providers
  - more Smartphones
  - more Merchant acceptance of contactless payments

Mobile Payments

- ✓ Mobile payment solutions may involve a mobile network operator (MNO) participating in the offering along with a financial institution.
- ✓ For some mobile payment solutions, the handset is simply a device for authentication and there may be no wider involvement of the MNO.
- ✓ Examples of new innovations:
  - NFC terminals
  - Mobile POS
  - Retailer Mobile Apps
  - Digital Wallets
  - Peer to peer mobile payments

On-line payment accounts

- Accounts through which you can send money, make payments online, and receive money
- may be regulated as non-bank payment institutions
- Paypal

Robot Advisor

Robot Advisor

- Automated financial advice (computer based algorithms and decision trees)
- "Robo Adviser" for investments – automated wealth managers offering financial advice
- More sophisticated models are being deployed using artificial intelligence
- Typically, a license is required to provide these services

Shadow Banking

Shadow Banking

- A shadow banking system is the group of financial intermediaries facilitating the creation of credit across the global financial system but whose members are not subject to regulatory oversight.
- The shadow banking system also refers to unregulated activities by regulated institutions.

Shadow Banking

- Within shadow banking, the biggest growth area has been "collective investment vehicles," a term that encompasses many bond funds, hedge funds, money markets and mixed funds.
- It poses particular danger because of its volatility and susceptibility to "runs" and is part of the "significant risks"

Shadow Banking

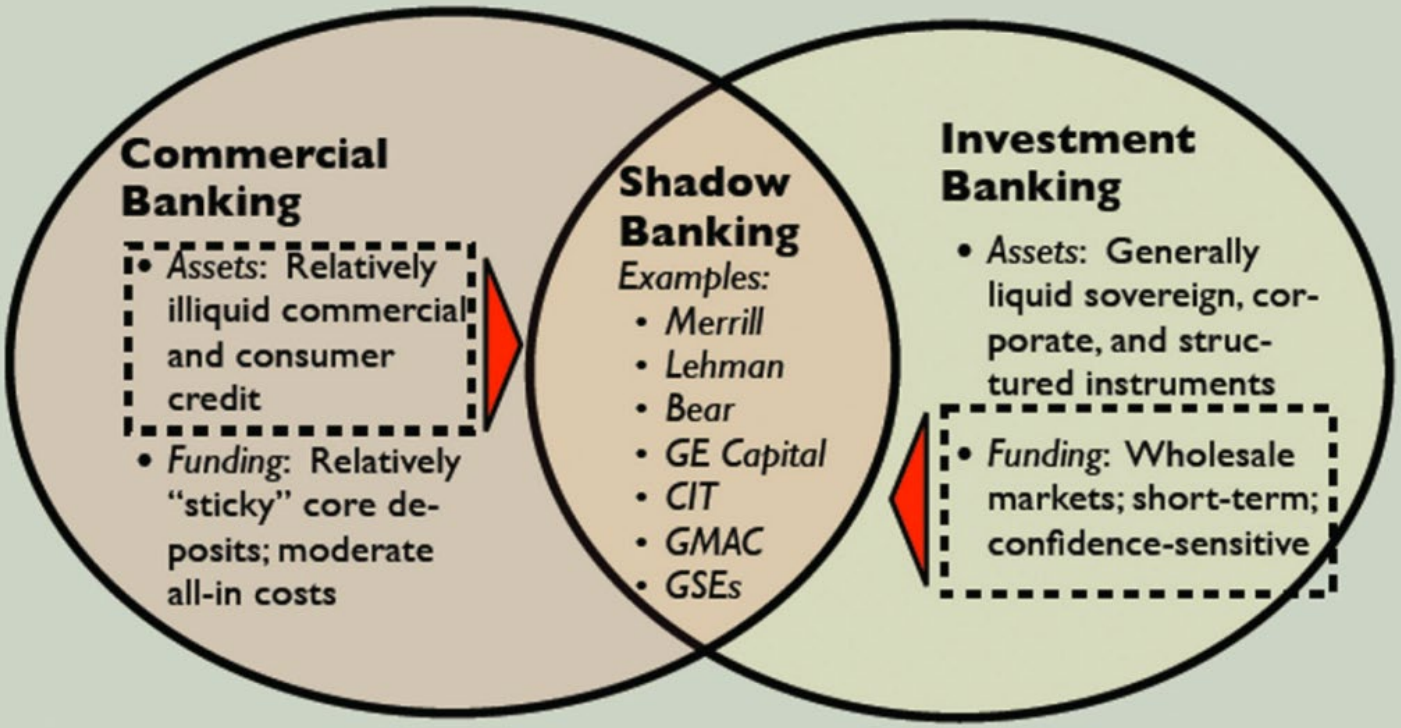
- When most people think of banks, they think of traditional commercial banks like Wells Fargo, Bank of America, Citibank and others. What makes these institutions true banks is the fact that they take deposits from savers and lend them out to borrowers in the form of mortgages, car loans and other debt. These traditional commercial banks are heavily regulated by federal and state authorities and must abide by Federal Reserve bank restrictions.
- Shadow banking, on the other hand, refers to any type of lending provided by financial institutions that are not commercial banks and not regulated as banks. Like traditional banks, shadow banks rely on short-term funds to make longer-term loans. That's where the similarities end. Since shadow banks are not depository institutions, they do not have deposits to lend out to borrowers. Instead, they rely on money from investors for making loans.

Shadow Banking

- The shadow banking system consists of lenders, brokers, and other credit intermediaries who fall outside the realm of traditional regulated banking.
- It is generally unregulated and not subject to the same kinds of risk, liquidity, and capital restrictions as traditional banks are.
- The shadow banking system played a major role in the expansion of housing credit in the run up to the 2008 financial crisis, but has grown in size and largely escaped government oversight even since then.

FIGURE 2

SHADOW BANK DEFINITION



Source: Cambridge Winter Center

Shadow banking is now a $52 trillion industry, posing a big risk to the financial system

PUBLISHED THU, APR 11 2019•1:18 PM EDT | UPDATED THU, APR 11 2019•5:01 PM EDT

Jeff Cox
@JEFF.COX.7528
@JEFFCOXCNBCCOM

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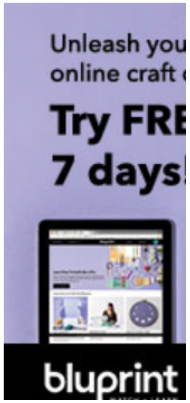
KEY POINTS

- Nonbank lenders, often called "shadow banks," now have $52 trillion in assets, a 75% increase since the financial crisis ended.
- The industry was at the center of the financial crisis when the subprime mortgage market collapsed.
- Industry officials say shadow banks still face considerable regulation and can help provide buffers in times of stress.



Shadow Banking

- The difference? Unlike deposits that are FDIC insured, investor dollars collected through the shadow banking industry are not insured. It seems simple and straightforward, but that simple difference alone creates a major risk for investors and for the entire financial system.
- These institutions helped fuel the crisis by providing lending to underqualified borrowers and by financing some of the exotic investment instruments that collapsed when subprime mortgages fell apart.
- The companies face less regulation than traditional banks and thus have been associated with higher levels of risk.

Risk No. 1 – Investor Safety

- Bank deposit accounts and money market accounts are insured by the FDIC and pose very little risk to account holders. Money market funds and other short-term, non-bank savings vehicles — the funding source for many shadow bank lending operations — are not insured. There's really nothing wrong with providing investors with a decent short-term return in exchange for using their funds to make longer-term loans at higher rates, and conceptually, if investors understand these risks, then there should not be a problem. That's how commercial banks have operated for centuries.

Risk No. 2 – Liquidity

- Just as an engine needs gasoline to run, the financial system needs access to short-term capital in order to operate. Banks and nearly every other monetary institution rely on access to short-term funds to meet liquidity needs and financial obligations. Real banks can access short-term funding in many ways that shadow banks cannot.
- When there is no short-term funding available, institutions that rely on it will suffer and possibly even fail in a short period of time. This is the reason the 2008 financial crises became so dangerous so quickly.

Risk No. 2 – Liquidity

- Since 2011, the Financial Stability Board, an international body that monitors and makes recommendations about the global financial system, has been monitoring the shadow banking system worldwide.
- To put things in perspective, shadow banking is now larger than the world economy in terms of total GDP, according to the report.
- The good news is that shadow banking has been a major contributor to economic expansion since the 2008 financial crisis. The bad news is that there is always a balance between risk and reward. When the reward seems too great, the risk probably is too.

Risk No. 3 – Recession

- It's very difficult to predict a recession ahead of time, and the real causes often only become clear well after the fact. Looking back to the 2008 financial crisis, there were a lot of factors at play. Regardless of the specific cause or causes, there is no doubt that shadow banking played a major role in the severity of the crisis. A late 2018 Bloomberg article on shadow banking summarizes the role it played and points out that the most devastating liquidity problems were not due to a "run" on traditional banks as in the Great Depression. Rather, they were a result of problems caused by non-bank institutions like Lehman Brothers and Bear Stearns. With any portion of the economy being so dependent on an industry as large as shadow banking, there are bound to be risks involved.

Risks from FinTech

- Businesses focused on the “Tech” and not the “Fin”
- may lack banking experience
- Cybercrime
- Data security/data protection
- Potential user anonymity/AML risk
- Volatility created by ease and speed of transfer of funds
- Increasing regulatory scrutiny

Regulation of FinTech

- RegTech broadly means technologies that facilitate the delivery of regulatory requirements.
- Deutsche Bank, JP Morgan, Santander and HSBC have all allocated teams to explore investment opportunities in the RegTech sector.
- Governments are beginning to work with companies to identify ways to support the adoption of new technologies to facilitate the delivery of regulatory requirements.
- RegTech can reduce a client's regulatory and compliance costs, automate the certain compliance tasks and reduce risks.

Approaches to FinTech Regulation

- Active Approch:
  - Regulators work closely with startups to understand new fintech developments and upcoming obstacles and to help startups address these challenges
    - Examples: early collaboration with industry in drafting regulation; regular feedback/explanations of rationale during regulation process, collaboration with startups to help develop their product aligned with regulation
  - Requires intensive use of regulatory resources and risk that agencies will become overwhelmed
  - UK's Financial Conduct Authority (FCA) uses an active approach

Approaches to FinTech Regulation

- Passive Approach:
  - National regulators do not play an active role in trying to make fintech companies succees, but they don't stand in their way. German regulator, BaFin, has historically taken this approach
- Restrictive Approach:
  - Governments that are risk averse, have large bureaucracies or fear regulatory capture by the industry may take this approach. The United States is an example.