Discussion Questions and Answers: Chapters 2−23

Chapter 2: The Fintech Landscape: A Bibliometric Analysis

(1) Explain the contribution of bibliometrics in understanding the fintech research landscape.

Bibliometrics provides a systematic and quantitative analysis of scholarly publications, citations, and collaboration networks in fintech. It enables assessing the research landscape by identifying publication trends, citation patterns, influential publications, prolific authors, and research institutions. By analyzing thematic clusters and distribution of research output, bibliometrics helps identify emerging trends and provides insights into the prominence of different research themes within fintech.

(2) Discuss how integrating diverse disciplines contributes to an understanding of fintech.

The study highlights the need for methodological advancements and the integration of diverse disciplines to foster an understanding of fintech's multifaceted nature. By drawing insights from various disciplines such as finance, technology, economics, and social science, researchers can gain a holistic view of fintech innovations' complex interactions and implications, enabling a more informed analysis and decision-making.

(3) Explain the prominent themes and trends within fintech identified through the bibliometric analysis.

The bibliometric analysis identified 23 themes within the fintech literature, covering a broad spectrum of topics. These topics include technological advancements, financial inclusion, regulatory compliance, innovation, data analytics, alternative finance, sustainability, global factors, business strategies, infrastructure, governance, consumer behavior, and more. These themes provide insights into the key areas of inquiry and emerging trends within fintech.

(4) Provide examples of how the study's findings can be leveraged to drive innovation and advancements in the financial industry.

The study provides valuable insights for industry practitioners to understand and leverage fintech developments. Industry professionals can stay informed about the forefront of fintech research by identifying influential publications, prolific authors, and their affiliations. Additionally, the distribution of research output across themes offers guidance

for industry players to align their strategies and investments with the emerging trends in fintech.

(5) Identify potential research directions and areas for further exploration within fintech.

The study's analysis reveals research gaps and areas with limited scholarly attention within fintech. These gaps present opportunities for future research endeavors and interdisciplinary collaborations. Researchers can explore emerging health and pandemic implications, cultural factors, regulation and legislation, risk and security, international finance, financial centers, efficiency and productivity, and decentralized finance. By addressing these research gaps, scholars can contribute to advancing knowledge in fintech and drive innovation.

Chapter 3: Use Cases in Fintech

(1) List fintech's main use cases that enhance financial services and promote financial inclusion.

Fintech's main use cases relative to enhancing financial services and promoting financial inclusion are (1) digital payments and transfers, (2) digital lending, (3) digital wealth management, and (4) digital insurance.

(2) List the areas where fintech applications can support and bolster financial institutions' management.

Fintech applications for supporting financial institutions' management include (1) risk assessment and management, (2) know your customers, (3) brand and reputation management, and (4) fraud detection.

(3) Discuss fintech's role in supporting financial inclusion and sustainable growth.

Fintech, particularly digital finance, is pivotal in driving global financial inclusion by extending access to banking services to billions of previously unbanked or underbanked individuals. These individuals now have the opportunity to engage in fundamental financial activities, such as savings and borrowing, often through the convenience of their mobile devices. Moreover, digital lending and wealth management offer a fresh avenue for micro, small, and medium-sized enterprises (MSMEs) and startups to secure funding and efficiently manage their wealth. MSMEs account for 90% of businesses, 60%–70% of employment, and 50% of global gross domestic product. Sustained support for these enterprises can lead to more stable and sustainable economic growth. The ease of digital payments has also facilitated expanding healthcare services to remote and underserved areas, reaching a broader population and contributing to sustainable development. Within healthcare, digital insurance or insurtech has revolutionized how insurance coverage is provided, making it more accessible and efficient for customers.

(4) Describe how regtech can benefit legal supervision.

Regtech offers benefits to legal supervision from two distinct perspectives. First, from the government's perspective, regtech can be integrated into its internal control systems to enhance daily management. For instance, the Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system used by the US Securities and Exchange Commission (SEC) is a prime example of regtech's application in government operations. Second, from the standpoint of companies and organizations, developing and adopting regtech solutions can substantially aid the private sector in improving risk management for regulatory compliance and achieving more efficient compliance with government regulations.

(5) Explain the relationship between blockchain technology and cryptocurrencies.

Although widely applicable in various sectors such as smart contracts, financial services, supply chain management, manufacturing, healthcare, energy, and smart cities, blockchain technology originated as the underlying technology for cryptocurrencies like bitcoin. In its initial stages, blockchain technology's first generation primarily served to establish cryptocurrencies as a store of value. Subsequent generations of blockchain systems have evolved to offer more complex functionalities, enabling cryptocurrencies to function as in-system currencies or tokens to identify nodes (users) and initiate a sequence of verifications. These advancements have facilitated decentralized fundraising efforts that raise funds through cryptocurrencies, thereby giving cryptocurrencies purchasing power within blockchain-based ecosystems.

Chapter 4: Regtech Frontiers: Innovations, Trends, and Insights Redefining Compliance

(1) Define regtech in the context of financial services.

Regtech refers to a wide range of data-led technological solutions aiming at helping financial institutions comply with ad hoc regulatory requirements. It involves data, technology, and regulation. Regtech is a new breed of regulation and technology that aims to provide a novel suite of regulatory services, signaling a dynamic shift from manual to digital and smart compliance.

(2) Identify regtech's benefits and challenges.

Regtech's benefits include:

- *Automation and efficiency* by automating repetitive and manual tasks, saving time and costs, and reducing paperwork.
- *Enhanced compliance* by helping organizations navigate complex regulatory requirements and providing real-time monitoring and alerts.

- *Risk assessment accuracy* by us*ing* advanced analytics and machine learning algorithms.
- *Improved data security* by reducing unauthorized access to sensitive regulatory data.
- *Enhanced reporting transparency* by providing stakeholders, auditors, and regulators easy access to all relevant information.
  Regtech's challenges include:
- *Implementation and data quality* relating to integration, resource intensiveness, and data quality.
- *Data privacy* regarding potential data breaches and the need for robust data governance schemes.
- *Regulatory complexity* involves vast frameworks, heterogeneity of jurisdictions, and frequent changes.
- *Customization* pertains to potentially limited and costly capacity for tailored-made solutions to specific organizational needs, risk indicators, and typologies.
- *Technology dependency and vendor "lock-in"* involve outsourcing prudential risk, regtech implementation to service providers, and over-reliance on technology.
- *Regulatory lag* involves the pace of technological innovation relevant to regulatory innovation.
- *Workforce displacements and skills gaps* concern the need to reskill employees, a loss of jobs, and the potential lack of specialized technical skills.

(3) List regtech's applications (use cases) in the financial industry and the broader business world.

Regtech's applications in the financial industry and the broader business world concern:

- *Compliance management, monitoring, and reporting solutions* support financial institutions to comply with regulatory requirements by providing monitoring, reporting, and auditing tools.
- *Regulatory intelligence, reporting, and documentation solutions* to help financial institutions automate the process of submitting regulatory reports to regulatory authorities.
- *Risk management and assessment solutions* allow financial institutions to identify, manage, and assess various risks associated with regulatory compliance provisions.
- *Identity and fraud management solutions* provide financial institutions with tools to verify the identity of customers, employees, and other relevant stakeholders and to associate and triangulate the identity with potentially fraudulent transactions and illicit activities.

(4) Identify the most promising dimensions that will determine regtech's future.

   Promising dimensions that will determine regtech's future include:

- *Generative artificial intelligence* combines human and machine intelligence for compliance.
- *Digital and cryptographic asset tokenization* position and integrate "decentralized" and "disintermediated" digital and cryptographic assets within extant and new legal frameworks.
- *Detection of fraud, AML/CTF, and sanctions compliance* identify patterns, anomalies, or associations indicative of financial crime phenomena.
- *Decentralized compliance* powers regtech solutions for monitoring and compliance across centralized and decentralized value exchange environments.
- *Quantum computing* can develop post-quantum-resistant cryptographic techniques (PQC) to avoid redundant data encryption systems while ensuring financial data security, value, and integrity.
- *Environmental, social, and governance (ESG) sustainability and humanitarian regulation* integrate ESG considerations within broader, interconnected, and interrelated risk management approaches strategically and organizationally aligned to ad hoc business models and value creation mechanisms.

Chapter 5: Fintech's Impact on the Banking Industry and Financial Services

(1) Define financial intermediation and its core functions and explain what makes it an information business.

   Financial intermediation is an ever-evolving concept, adapting to changing economic landscapes. Financial intermediation has evolved substantially. Its theoretical basis has transformed from idealized market conditions to the practical realities of the financial world. Financial intermediation would have no role in a theoretically perfect market with complete information and negligible transaction costs. However, this idealized concept sharply contrasts with the historical and practical significance of financial intermediation throughout human history. Intermediation theory emerges as an attempt to explain the existence and importance of financial intermediaries in the presence of market imperfections, like transaction costs and asymmetric information. These imperfections are key factors in justifying the economic need for financial intermediaries.

   However, the traditional view of intermediation alone cannot explain why improvements in market imperfections have not led to reduced

intermediation levels. Financial intermediation is summed up by two fundamental functions: asset transformation and brokerage services. Asset transformation involves the process where financial intermediaries convert funds from savers or investors into different assets to meet the needs of borrowers, spenders, or other market participants. This transformation encompasses altering asset attributes such as duration, liquidity, credit risk, divisibility, and currency identity. The brokerage function of financial intermediaries encompasses fee-based activities that connect market participants with complementary needs, such as those needing capital and those with surplus capital or companies requiring intermediation for payment services. Through this role, financial intermediaries serve as crucial liquidity providers in the financial system. In both functions, information plays a crucial and strategic role. Better access to information regarding the quality and quantity of data can make financial intermediaries develop and maintain a competitive edge.

(2) Discuss how technology has shaped the financial services industry.

The financial services industry has a long history of investing in technology, dating back to the mid-19th century with the advent of the telegraph, which revolutionized communication in financial markets. Technological milestones include the pantelegraph and ticker tape for signature verification and financial information dissemination in the late 1800s. In the 1950s, mainframe computers automated financial processes, while electronic trading platforms began replacing open outcry systems in stock exchanges. The 1967 introduction of automated teller machines (ATMs) and the Quotron system providing real-time financial data marked new technological waves. The 1980s saw electronic communication networks (ECNs) enabling direct market access, leading to fully electronic trading on stock exchanges. The 1990s brought online trading and the rise of internet-based brokerages, democratizing access to financial markets. High-frequency trading (HFT) emerged in the early 2000s, transforming market dynamics with rapid trade execution. Despite these technological advancements, traditional financial institutions largely concentrated on expanding their product portfolios and operational efficiency, often leading to silos of information. Recent digitization efforts aim to streamline operations and reduce costs but do not fundamentally reevaluate value chains or align products with the digital age.

(3) Identify the domains that fintech has affected and discuss this impact.

Fintech has profoundly affected several domains within the financial services industry, with notable consequences for traditional financial intermediation. Particularly, lending and payments domains have experienced major disruptions due to the emergence of fintech and big tech firms. Several factors drive the disruption in the lending space. Stricter regulatory requirements for traditional financial institutions have created opportunities for fintech firms. Regulatory arbitrage and the lack of

traditional financial infrastructure in some regions have facilitated a trend toward disintermediation. Fintech and big tech companies directly connect borrowers and lenders through online platforms, bypassing traditional financial institutions. Peer-to-peer (P2P) lending platforms, such as LendingClub and Prosper, and e-commerce giants like Amazon and Alibaba, providing loans to small businesses, exemplify this trend. Big tech firms can leverage their access to detailed data acquired through trading records or payment information to evaluate creditworthiness, partly replacing the brokerage function of traditional financial intermediaries.

Fintech and big tech companies have made substantial inroads in the payments domain, challenging traditional financial institutions. Tech giants like Google, Apple, and Alibaba, along with PayPal, offer comprehensive payment solutions and have become preferred interfaces for customers. They bundle various services, transforming them into "super platforms" that provide various products and services previously offered by traditional financial institutions. This approach leverages their online platforms and mobile applications to create one-stop-shop solutions. Tencent's WeChat is a good example of this trend, offering a wide range of financial services, from payments to wealth management and showcasing the potential of super platforms.

DeFi is another disruptive force, providing services through blockchain technology and smart contracts, potentially reducing the reliance on traditional intermediaries. Open banking initiatives like PSD2 in the European Union enable fintech companies to access customer data, fostering competition and enabling new services. Robo-advisors have disrupted wealth management, offering automated investment advice and portfolio management. The insurance sector has also seen innovation through data analytics and artificial intelligence, enabling personalized policies and usage-based insurance models. Finally, challenger banks and neobanks have affected asset transformation, a core function of traditional banks.

(4) Explain how traditional financial intermediaries are responding to the fintech challenge.

Traditional financial intermediaries are actively evolving their strategies and operations to thrive in the digital age and remain relevant in a competitive landscape characterized by rapid technological advancements and new entrants. Specifically, they are adapting to the challenges posed by fintech and the digital era, recognizing the need to embrace technology and innovation to remain competitive. Their responses to this transformation include:

- *Collaboration and investment.* Many traditional financial intermediaries choose to collaborate with or invest in fintech startups. This strategy allows them to leverage the innovation and agility of fintech

firms while benefiting from the established customer base and regulatory compliance of traditional banks. For instance, the six largest banks in the United Kingdom have invested heavily in fintech firms engaged in payments, banking, and financial management solutions, representing 42% of the total funds allocated.

- *Digital service expansion.* Many financial intermediaries are expanding their online and mobile service offerings to compete with fintech firms. They introduce features like robo-advisors for automated investment management, digital payment wallets, and peer-to-peer (P2P) lending platforms, enhancing customer engagement and satisfaction.
- *Customer-centric approaches.* Recognizing the importance of a positive customer experience in retaining and attracting clients, some incumbent banks are shifting toward more customer-centric approaches. They emphasize personalization, offer financial advice, and improve customer service.
- *Digital transformation.* Traditional financial intermediaries are undergoing digital transformation, continuously improving their properties using information, computing, communication, and connectivity technologies. This transformation is evident in reducing physical branches in certain countries, signaling a gradual shift from the traditional brick-and-mortar business model to a digital one.

Traditional financial intermediaries must recognize that they now compete with a broader range of firms, including fintech and big tech companies, neobanks, challenger banks, telecommunications companies, and retail firms, within various domains of the financial services industry. To navigate this changing landscape effectively, traditional financial intermediaries should:

- *Understand new competitors.* Financial intermediaries should gain a deep understanding of their new competitors' business models and processes, including fintech and big tech firms, to identify areas of collaboration or competition.
- *Leverage their centrality.* Traditional financial intermediaries, especially incumbent banks, can capitalize on their role as focal points for customer identification and reference data. This process includes verifying and protecting customer identities in online transactions, emphasizing the importance of identity in the digital age.
- *Embrace innovation.* Financial intermediaries must experiment with business models aligning with their strategic objectives, leveraging novel authentication protocols and communication standards as they adapt to the evolving financial services ecosystem.

(5) Discuss the future of the banking and financial services industry.

The future of banking revolves around technological innovation, customer-centric experiences, data-driven decision-making, sustainability, and responsible banking practices. Financial intermediaries are

poised to undergo a major transformation in the digital age, redefining their role in the financial services ecosystem. Specifically, the digital transformation of traditional financial intermediaries should occur by adopting platform-based business models. These models will leverage open banking and finance, allowing financial intermediaries to act as platform providers connecting buyers and sellers using digital technologies, particularly open APIs. This transformation will significantly expand their traditional brokerage capabilities. As platform providers, financial intermediaries can offer customer identification and verification services, account provision, and payment processing. This approach fosters a mutually beneficial ecosystem known as "fintegration," serving as a role model for banks to enter other industries, connect with various applications and platforms, and access new data, ultimately realizing the concept of banking anywhere and anytime.

Under platform-based models, financial intermediaries will effectively transition from money brokers to services brokers, with data as a central asset. They will harness data analytics, including predictive analytics and AI, to enhance customer service, predict customer needs more accurately, and address legacy challenges. This transition enables financial intermediaries to be more agile and embrace innovation in a rapidly evolving industry. To succeed, financial intermediaries must become "digitally ambidextrous," balancing core capabilities with exploring new opportunities, experimenting, and remaining ambitious. In the future, financial intermediaries should shift from fixed product and service propositions to more tailored and dynamic offerings based on customer needs and data-driven insights. Financial services will evolve toward providing experiences rather than products. Digital interfaces, including chatbots, holograms, and augmented reality, will enhance and personalize customer service and convenience. Additionally, AI will play a pivotal role in banking, particularly for financial intermediaries with access to well-structured data. At the same time, privacy and trust will be paramount, making financial intermediaries trustworthy allies in safeguarding customer data.

Emerging technologies like quantum computing will expedite processes and enhance data-driven models. Central bank digital currencies (CBDCs) may also draw attention, offering faster and more secure payments, improved financial inclusion, and enhanced monetary policy implementation. Moreover, financial intermediaries should focus on sustainability and ethical banking practices, supporting environmental causes and encouraging green investing. They can leverage digital channels to communicate sustainability initiatives and incorporate eco-friendly practices into their products, such as recommending green investment opportunities based on carbon emissions data.

Chapter 6: Mobile Payments and Digital Banking Services

(1) Describe the digitalization of the payments system.

Digitalization of the payment system uses electronic means of paying for goods via transferring funds from the buying party to the selling party or similar transactions to move funds from one entity to another.

(2) Identify the two countries with the most market share of digital consumer commerce transactions and discuss the future growth outlook.

China and the United States have the greatest market share of transactions at 42% and 27% in 2022, respectively. The growth in total digital payments is about 12.1%, compounded annually.

(3) Define mobile payment and identify the leaders in mobile payments in the United States.

Mobile payment is paying on the go, typically using a contactless POS (point of sale) payment system. Most are completed using Bluetooth Low Energy (BLE) or Near Field Communication (NFC) devices. The majority of these transactions worldwide are done using a smartphone. In the United States, companies such as Apple (via Apple Pay), Alphabet (via Google Pay), Venmo, and Zelle are some of the leaders in mobile payment transactions.

(4) Discuss the long-term growth trend in mobile payments and how it relates to all digital payments.

The trend in mobile POS payments has been increasing. In 2022, US mobile digital payments were about 31% of digital payments, China was over 44%, and Sweden was almost 37.5%. These payments are expected to grow to 36.4%, 48.8%, and 44.9%, respectively, by 2027. If China and Sweden follow a long-term trend, mobile payments will exceed 50% of all digital payments.

(5) Explain the recent impact of cash and check usage and discuss the most predominant methods.

Business-to-business (B2B) transactions still rely on cash and check payments. In contrast, usage has dropped to nine points to 33% in North America (31% worldwide). ACH credits have increased to 39% and debits to 7%. Wires make up 13% of business transactions.

(6) Discuss how Swish changed the payment landscape in Sweden.

Sweden has about 7% of all transactions reported as completed via cash and other paper-based payments. Card payments comprised about 58% of transactions, as reported by the central bank in 2019. Swish is a contactless payment app managed by Getswish in cooperation with six major banks. Most daily transactions can be completed using the Swish app on a smartphone. Although the average value is small, it indicates widespread use for all levels of transaction values.

Chapter 7: Marketplace Lending Platforms for Borrowers and Investors

(1) Define the term marketplace lending.

Marketplace lending (MPL), often called peer-to-peer (P2P) or platform lending, is a relatively new type of lending that uses online platforms to connect consumers or businesses who seek to borrow money with investors willing to buy or invest in the loan. The MPL model started with the promise that individuals could borrow from often unsophisticated lenders directly and P2P, but now more institutional investors fund MPL activity. An online platform matches borrowers and lenders without a traditional bank as an intermediary. Today, the terms "peer-to-peer lending" and "crowdlending" have largely replaced the term "marketplace lending."

(2) Discuss how market risk factors affect borrowers in MPL.

Marketplace borrowers are often independent of market risk. An idiosyncratic factor describes the correlation of each borrower to market risk. A high idiosyncratic factor means that a borrower is largely independent of market risk factors. Modeling risk in MPL to stress portfolios assumes high idiosyncratic risk factors and a high correlation between borrowers.

(3) Explain why risk assessment is difficult in portfolios of marketplace loans.

In MPL portfolios, a high degree of fuzzy and hidden information prevails, which leads some investors to view MPL as less safe than bank loans. For instance, how borrowers are correlated is largely unclear, which might lead to higher risk than initially perceived.

(4) Identify which techniques can efficiently simulate risk in MPL portfolios.

MPL platforms and lenders should use stochastic (random) processes like Monte Carlo simulation and machine learning (ML) techniques. Deterministic processes, such as scenarios, often fail to capture tail risk appropriately because of bias and hidden information. Stochastic processes like Monte Carlo analysis can simulate all possible scenarios despite fuzzy and missing information. However, Monte Carlo analysis is CPU-heavy and introduces a computation bottleneck when investors have to model portfolios with many loans. Therefore, better alternatives include machine learning approaches, such as Chebychev Tensors (CTs) or Deep Neural Networks (DNNs). These techniques create proxies for cases of tail risk that approximate those in Monte Carlo analysis while using much less CPU power.

(5) Discuss how MPL can improve sustainability and become a viable alternative to bank lending.

All credit loans have risk, including bank credit loan portfolios. When market conditions change quickly and unexpectedly, they may generate lower returns than the cost of their short-term liabilities because they contain mainly fixed long-term loans. This situation led to the collapse of Silicon Valley Bank in 2023. Because marketplace loans typically have a shorter duration, portfolios of such loans can be rebalanced quicker to react to changing market conditions. For this reason, MPL can be a sustainable alternative to bank lending, but only if investors understand the risks involved. Modeling their risks is complex and requires specific expertise and techniques. They often contain fuzzy and hidden information, and the ratings of counterparties change in changing market conditions.

Chapter 8: Risk Management in Fintech

(1) Identify the primary technological innovations reshaping the fintech landscape.

Several technological innovations are reshaping the fintech landscape, including robo-advisors offering personalized investment solutions, blockchain enabling transparent transactions, AI algorithms optimizing credit scoring and fraud detection, and digitization facilitating real-time transactions and data-driven decision-making.

(2) Discuss how technology risks impact the sustainability of fintech ventures.

Technology risks, such as cyberattacks, data breaches, and biases in AI models, can severely impact the sustainability of fintech ventures. These risks can lead to financial losses, erode customer trust, hinder further growth and innovation, and even result in regulatory non-compliance, all of which threaten the viability and stability of fintech companies.

(3) Explain how fintech contributes to financial inclusion and identify the challenges that could hinder this progress.

Fintech contributes to financial inclusion by offering services like mobile money platforms and AI-driven credit scoring that enable access to financial services for underserved communities. However, challenges such as the digital divide, lack of trust, language barriers, and data privacy concerns hinder the full realization of financial inclusion through fintech.

(4) Discuss how collaboration among fintech companies, regulators, and policymakers can responsibly shape the future of digital finance.

Collaboration among fintech companies, regulators, and policy-makers is crucial for fostering a responsible and inclusive digital financial future. It can lead to establishing robust regulatory frameworks, open dialogues to address emerging challenges, sharing best practices, and

investing in research and development to ensure fintech's ethical and sustainable growth.

(5) Discuss why robust technology risk management is imperative for the long-term success of fintech ventures.

Robust technology risk management is vital for the long-term success of fintech ventures because it safeguards viability, protects customer data, fosters trust, and ensures compliance. Failure to manage technology risks can lead to dire consequences like cyberattacks, reputational damage, and financial instability, hindering growth and innovation while jeopardizing the future of fintech companies.

Chapter 9: Capital Formation and Crowdfunding

(1) Discuss a company's developmental stage and valuation level before it is eligible for funding by an angel or a VC firm.

Angel investors typically invest in a company's seed round, while venture capital firms often come in later rounds, such as the A, B, and C rounds of funding. Companies in the seed stage of funding are often valued at $5 million to $15 million, while later rounds typically have valuations exceeding $15 million. As a result, companies with a valuation below $5 million often have difficulty obtaining funding from angels or VC investors.

(2) Describe the qualifications for accredited investors and the exemptions from regulation that status provides.

Accredited investors can qualify to invest in private placements through educational or wealth-related attributes. PE, VC, and hedge funds have raised the largest capital from accredited investors and institutional investors. Accredited investors can qualify by earning a sustainable individual income of $200,000 annually or $300,000 as a married couple. To qualify by wealth, accredited investors need to have a net worth exceeding $1 million, excluding the value of their primary residence. Recent amendments to the accredited investor standards allow financial professionals to qualify by education, such as by passing specific FINRA regulatory exams or being designated as a knowledgeable employee of a private placement issuer, such as a PE fund.

(3) Explain Regulation Crowdfunding and how the regulation facilitated capital formation by small businesses.

Before the JOBS Act, private companies could only access equity capital through angels or VC funds. Companies with valuations below $5 million had difficulty raising capital from these large and institutional investors. Regulation Crowdfunding allowed retail investors to purchase equity interests in small firms, with companies limited to raising $1 million in any 12-month period. Regulation Crowdfunding allowed more

investors and companies to be directly involved in equity investments in small private companies.

(4) Name the three parts of the Howey Test to determine when the SEC requires that a fundraising offering be registered as a security.

According to Howey, the three tests for determining whether fundraising is a securities offering are (1) an investment of money, (2) in a common enterprise, and (3) a reasonable expectation of profits to be derived from the efforts of others.

(5) Name and explain four different types of crowdfunding.

The four types of crowdfunding are donations, rewards/preorders, debt, and equity. Donation crowdfunding, such as GoFundMe, uses the power of the crowd and social media to raise funds for a worthy cause, such as for a community after a natural disaster. Rewards or preorder crowdfunding provides funders of business access to an event or an item produced by the entity using the funds raised. Debt crowdfunding provides capital to a business, with the funders repaying the principal and interest on their original investment. Equity crowdfunding gives investors an equity stake in the entity receiving the invested capital.

Chapter 10: Demystifying Robo-Advisors: Benefits and Limitations

(1) List the main benefits of robo-advisors compared to human financial advisors.

Below are the main benefits of robo-advisors (robos) relative to human financial advisors.

- Robos may be more cost-efficient for clients but may lack transparency.
- Robos may save costs for asset managers.
- Access is possible 24/7 from everywhere with a mobile device.
- Robos use a quantitative investment approach, which may be more rational investors than humans.

(2) List the potential limitations of automated investment advice.

Automated investment advice may have the following limitations.

- Risk profiling may be insufficient.
- A lack of empathy may be an issue during crises.
- Robos are not free from conflicts of interest.
- Investors may be technology-skeptics and lack trust in robo-advisors.

(3) Discuss if robo-advisory is a long-term disruptive force or a short-term fad.

Arguments support both perspectives. Since robo-platforms increase efficiency for asset management companies, they will probably shift new

and less profitable clients to their robo-advisors, which causes a long-term disruptive trend for a certain segment of investment clients. Also, since younger people are open to technology, the trend toward robo-advisory may strengthen as young clients gain more wealth to invest. Robo-advisory quality may improve with technological advancements, making it a dominant investment advisor.

Yet, a risk exists regarding the long-term disruptive potential, which could downgrade robo-advisory to a short-term fad. As with crypto-currencies, scandals like heists and hacks could lead to mistrust in robo-advisors. A major stock market crash could cause a loss in wealth and hence reduce investment volumes in robo-advisory. If robo-advisors strongly underperform in a market crash, this could result in a permanent mistrust of the technology.

(4) Explain whether investing with robo-advisors involves ethical dilemmas.

An important ethical question is who takes responsibility for auto-mated investment decisions: the algorithm, the developer, or the investor? Overconfidence in technology could cause unintended conse-quences and risks to financial market instability. Robo-advisory depends on personal data, making data protection and cybersecurity essential since the exposition of sensible information would also constitute an ethical dilemma. Automated investment decisions may also be a "black hole" regarding ESG stock screening. Although many robo-advisors offer sustainable portfolios, they might not always meet investors' ethical preferences. Finally, the potential integration of AI is also a source of ethical predicaments (e.g., if the reference data are biased and cause unintended discrimination).

(5) Identify the essential factors that individual investors should know when choosing a robo-advisory vendor.

When choosing a robo-advisor, individual investors should know the vendor's:

- Fees and costs.
- Track record regarding past returns and risks.
- Location.
- Quality of recommendations involving personalization or customization.
- Investment strategy.
- Reputation and user experience.

Chapter 11: Online Trading: Part I

(1) Discuss two types of financial markets.

There are exchange and OTC markets. An exchange market is char-acterized by a central limit order book (CLOB) where supply and

demand cross. OTC market is any other type of market where buyers and sellers meet. The most basic financial OTC market is a bilateral market in which one buyer or seller contacts a dealer to request a quote. Computers allow for more complex trading protocols, including RFQ or RFM, where buyers and sellers can ask for available quotes from multiple dealers. Unlike exchange markets, OTC markets are characterized by bilateral transactions, where a trader can pick up quotes on exchanges from multiple other market participants.

(2) Discuss how online trading affects the investment process.

Online trading increases competition among brokers to offer better prices to their clients. It also facilitates dispersing information across market participants, like current market prices. Online trading has great potential for automation and can improve liquidity.

(3) Describe a popular trading protocol on an electronic trading platform in the OTC markets.

A popular trading protocol is RFQ, where a trader specifies an asset's quantity and the trade's desired direction. The contacted dealers can then respond with a quote they are willing to trade. This situation is a first-price auction that a trader can hold among several dealers. The advantage of this protocol is increased competition. However, the trader also gives information about intended trades to many dealers. The RFM protocol, in which two-sided quotes are requested, aims to reduce this concern by not revealing the trade's intended direction. Moreover, two-sided quotes indicate the markup the dealer is charging.

(4) Define the NBBO and describe how it affects the brokers' routing of client orders.

The NBBO is the best price offered on the available exchanges for a security. A broker should consider the client's best interests and avoid trade-throughs at prices worse than the NBBO.

(5) Define PFOF and discuss why it is controversial.

PFOF is a practice in which a market maker pays a broker to execute the trades of the broker's clients. A controversy centers around whether this practice incentivizes the broker to act in the client's best interests, as the compensation may not get passed through to the client.

(6) Discuss some advantages of centralized over decentralized markets.

Exchange markets have market makers compete directly, potentially leading to more competitive prices for liquidity takers. Search costs are lower in a centralized structure. However, research suggests that decentralized markets could better cope with problems related to asymmetric information.

Chapter 12: Online Trading: Part II

(1) Explain online trading's benefits and drawbacks.

    The benefits of online trading include greater price transparency, increased liquidity, decreased trading costs, and decreased slippage costs. A drawback of online trading is front-running conducted by high-frequency trading firms based on the availability of customer order flow information. Moreover, developing highly advanced trading systems may lead to sudden and unexpected market sell-offs due to the large quantities and rapid speeds at which these systems operate.

(2) Discuss the advantages and disadvantages of selling customer order flow.

    The sale of customer order flow allows market makers to earn substantial revenue and simultaneously offer zero-commission trading. Additionally, market makers are less likely to face adverse selection since they do not have to differentiate between small retail orders and large institutional orders. A disadvantage is that selling customer order flow has led to front-running by high-frequency trading firms, thus leading to increased regulatory scrutiny. Retail investors benefit from more attractive execution but experience potentially wider bid-ask spreads when compared to larger institutional clients. Moreover, retail investors are less likely to be subject to adverse selection.

(3) Discuss how market participants use AI and ML to accomplish their trading strategies.

    AI and ML refer to models using computational methods to reach optimal predictive performance on a data set by learning from that data. The goal is to generate a model that can perform a predictive task without explicit instruction or programming. Rather than directly attempting to predict future security prices, the models are more commonly used in risk management applications that govern various trading strategies. They are also used to model non-linear and highly complex data relations that require a large dataset.

(4) Explain how Robinhood revolutionized the retail trading business.

    Robinhood has disrupted the traditional brokerage model by allowing users to trade stocks, ETFs, options, and, more recently, cryptocurrencies under a commission-free trading model through a simple mobile interface. The mobile interface's ease of use and Robinhood's no-account minimums and zero-commission model have democratized stock market investing for young and less experienced investors. As the first broker to offer commission-free trading, Robinhood catalyzed the entire industry's transition toward commission-free trading.

(5) Describe how retail traders may use APIs to develop trading strategies.

    In the trading strategy development process, retail traders may use APIs for overall strategy development, research, back-testing, and execution. This process is accomplished by accessing historical and real-time market

data, allowing the execution of trades from their software. As a result, retail investors may now engage in more sophisticated trading strategies that can be automized, customized, and better controlled.

(6) Describe how alternative and traditional data sources differ.

Alternative and traditional data sources differ because alternative data are derived from various sources and are used to supplement or predict traditional data sources. Alternative data sources include satellite imagery, social media, web scraping, and wearable devices. By contrast, traditional data sources include more conventional data points such as financial statements, stock prices, daily volume, and earnings calls.

Chapter 13: Personal Finance Applications of Fintech

(1) Define fintech.

Fintech, a contraction of "financial technology," refers to applying cutting-edge technology to optimize and automate the delivery and utilization of financial services. It is a swiftly expanding sector that employs novel technological solutions to modernize traditionally manual financial tasks, increasing efficiency, user-friendliness, and reach.

Fintech encompasses various applications, from mobile banking and peer-to-peer payments to wealth management, crowdfunding, insurance, and blockchain transactions. The rise of fintech companies has transformed the financial services landscape, offering new opportunities for startups and challenging established financial institutions to innovate and adapt. This evolution has significant implications for consumers, who now have access to more digital financial tools and services than ever.

(2) Identify advantages of fintech.

Fintech offers the following advantages.

- *Efficiency and convenience.* Fintech solutions, such as digital payments, mobile banking, and automated investment platforms, enable users to manage their financial affairs conveniently from anywhere, at any time.
- *Accessibility.* Fintech can provide financial services to unbanked or underbanked populations, offering access to banking, loans, and other services that might be unavailable in their locality or for which they might not qualify traditionally.
- *Personalized services.* Many fintech companies use artificial intelligence and machine learning to analyze user data and provide personalized financial advice, tailored products, or risk assessments.
- *Lower costs.* Fintech companies often operate with less overhead and regulatory constraints than traditional banks, resulting in lower fees for services such as money transfers, personal loans, and asset management.

- *Innovation.* Fintech companies are at the forefront of financial innovation, developing new products and services, such as robo-advisors for investment management and blockchain-based solutions for secure, transparent transactions.
- *Improved financial literacy.* Many fintech applications provide financial education resources, helping consumers make more informed financial decisions.

(3) Suggest how fintech can serve the underbanked and raise financial inclusion.

Fintech can serve the underbanked and raise financial inclusion in several ways.

- *Digital banking services.* Fintech can bring banking services to remote and underprivileged areas where traditional banks might not have branches. Mobile banking allows users to make deposits, transfers, and payments using a smartphone, reducing the need for physical bank visits.
- *Peer-to-peer lending.* Through fintech platforms, individuals and small businesses that might not qualify for traditional bank loans can access microloans or connect with P2P lenders.
- *Financial literacy tools.* Fintech can offer educational tools and resources to improve financial literacy among the underbanked, helping them understand how to manage money, use financial services, and plan for the future.

(4) Identify how fintech may help reduce personal financial mistakes.

Fintech provides several ways to help reduce personal financial mistakes.

- *Automated budgeting and saving.* Fintech applications like budgeting tools can automatically track income and spending, categorize expenses, set spending limits, and even automate savings. These apps can help individuals avoid overspending and ensure they are saving consistently.
- *Investment guidance.* Robo-advisors and other automated investment platforms can help users avoid common mistakes, such as poorly diversified portfolios or panic selling. These tools use algorithms to create and manage a diversified portfolio based on the user's risk tolerance and investment goals.
- *Alerts and reminders.* Fintech applications can send alerts when users are nearing their budget limit, when bills are due, or when unusual account activity is detected. These notifications can prevent missed payments, overdraft fees, and potential fraud.
- *Debt management.* Fintech solutions can help users manage and reduce their debt. Some tools consolidate loans or negotiate lower interest rates on the user's behalf, while others provide strategies to pay off debt more efficiently.

- *Real-time data access.* Fintech tools provide real-time access to financial data, giving users an accurate and up-to-date picture of their financial situation. This instant feedback can help users avoid making decisions based on outdated information.

(5) Explain multifactor authentication (MFA) and how it raises security in personal banking.

Fintech applications often implement MFA to add an extra layer of security. Besides a username and password (what the user knows), users are required to provide an additional form of verification (what the user has), such as a one-time password (OTP) sent to their registered mobile device or biometric authentication such as fingerprint or facial recognition. MFA mitigates the risk of unauthorized access even if passwords are compromised. This dual verification ensures a high level of security. Thus, MFA may be difficult to replicate and ensures only authorized individuals can access their personal banking accounts or perform transactions.

Chapter 14: Blockchain in Fintech: A Catalyst for Disrupting the Financial World

(1) Define blockchain.

Blockchain is a distributed ledger technology (DLT), which is a decentralized and encrypted digital storage system of information to protect data and manipulation. Information is recorded in blocks linked to a previous block of data to keep the order of records and track any historical transaction. New data are only included after a governing body of nodes reaches consensus, more commonly through proof of work (PoW) or proof of stake (PoS). Although blockchain awareness is due to its use in cryptocurrencies, some companies are developing blockchain solutions specific to companies.

(2) Identify some blockchain advantages.

Some advantages associated with blockchain follow.

- *Consistent.* All users keep the same copy of information across the ledger.
- *Democratic.* All participants agree on the rules to manage the network.
- *Resilient.* Information is accessible, even when many peers are offline.
- *Secure and accurate.* Digital keys and signatures protect information integrity. Keys are easy to set and almost impossible to undo.
- *Segmented and private.* Access levels within the network can be customized.
- *Permanent and tamper-resistant.* Historical records cannot be changed without the complete agreement of all network members.

- *Quickly updated.* Networks record new transactions almost in real time.
- *Intelligent.* Users can program event-triggered transactions using smart contracts.
- *Verifiable.* Anyone can review if transactions comply with the system rules.

(3) List some blockchain applications in the business world.

The following are blockchain applications in business:

- Compensation processes among banks.
- Supply chain documentation and product tracking.
- Smart contracts.
- Healthcare records.
- Identity management systems.
- Notarized services.
- Regulatory processes like Know Your Customer (KYC) and fraud prevention.
- Tokenization of real estate.
- Decentralized finance (DeFi).
- Fair payment.
- Triple-entry accounting.

(4) Identify the major obstacles to the widespread adoption of blockchain technology.

Below are some main obstacles to the widespread adoption of blockchain technology.

- Lack of knowledge and expertise in the technology.
- Integration with legacy systems.
- Investment cost.
- Environmental impact of consensus mechanisms like proof of work (PoW).
- Limited regulatory framework.
- Scalability.
- Process efficiency compared to current payment systems like VISA or Mastercard.

Chapter 15: Cryptoassets and Fintech

(1) Discuss the difference between cryptocurrencies and utility tokens.

Cryptocurrencies function as a medium of exchange, a unit of account, and a store of value. By contrast, utility tokens offer users consumptive rights to access services and products within a blockchain-based platform. Although utility tokens can be used as

cryptocurrencies beyond the issuer's platform, their main purpose is facilitating and promoting value creation within a specific ecosystem.

(2) Explain the difference between security tokens and tokenized securities.

Security tokens are designed as newly created securities native to the blockchain. They are created and exist solely within the blockchain environment without a physical or traditional equivalent. In contrast, asset-backed tokens or tokenized securities serve as digital representations of pre-existing assets or securities. Therefore, the key distinction lies in the origin and nature of these tokens. Security tokens are born within the blockchain and do not have an external presence beyond it. By contrast, tokenized securities represent existing assets or securities while maintaining their off-chain existence.

(3) Identify three features of stablecoins applicable to traditional finance.

Stablecoins have several distinctive features.

- They offer low costs, stable value, and fast settlements, making them reliable for fund transfers.
- Blockchain-based transaction records ensure transparency and security.
- Decentralized networks enable seamless transactions across borders and time zones.

(4) List three regulatory issues facing cryptoassets.

Cryptoassets face multiple regulatory issues and questions, especially in the United States.

- No consensus exists among regulators and policymakers about which agency has the purview to regulate cryptoassets, creating a murky and litigious operating environment.
- Because cryptoassets represent such a varied and fast-developing asset class, seeking to develop and implement regulations for the entire space creates inconsistencies that can create legal issues for crypto organizations.
- Having many cryptoassets and crypto organizations headquartered outside of the United States makes enforcing US reporting, disclosure, and investor protection standards more difficult, leading to uninsured investor losses.

(5) Describe the current and proposed accounting treatment and rules for cryptoassets under US generally accepted accounting principles (GAAP).

Under current US GAAP, cryptoassets are accounted for as indefinite-lived intangible assets. With this accounting treatment, cryptoassets are held at cost on an organization's balance sheet. The only changes allowed are losses in value as measured by an impairment test, but none of these losses can be recovered. Under the proposed accounting standard update, set to become effective by the end of 2023, cryptoassets such as bitcoin and ether will be reported and held at fair

market value, with any unrealized gains and losses shown in the financial statements.

Chapter 16: Big Data's Role in Fintech

(1) Discuss how big data has inspired innovation in the major contemporary tranche of modern financial services.

Notable fintech innovations affect at least four major tranches of modern financial services. First, cryptocurrencies use and create large data accumulations. Redundancies in recordkeeping in most blockchain systems used in crypto assure data availability from numerous sources. Smart contracts using blockchain also produce comprehensive big data records. Geographic decentralization avoids the single point of failure in centralized data structures. Second, big data lie at the heart of P2P systems, such as disintermediation using big data-enabled search and identification of dispersed investors (lenders), resulting in matching with dispersed borrowers. Third, AI-informed robo-advisory services use big data-fed AI to discover and incorporate alternative data sources that promise better identification of appropriate investment choices. Fourth, automated credit scoring involves big data-fed AI.

(2) Exemplify several emerging big data accumulations, then link them to a modern developing fintech practice, analytical method, or financial service.

Big data in modern fintech are sourced from existing public databases, proprietary databases, government databases, and newly installed or discovered sensors. Much data acquisition is an outsourced activity requiring contractual permission to use, retain, or resell data in license transactions. Data are a mix of numerical arrays in financial reporting using standardized formatting, such as XML. Increasingly, natural language data provides context, detail, and depth but requires AI for organization, selection, and interpretation.

(3) Explain how many legacy financial services were developed using big data and ICT innovations.

Most major financial services used and developed additional big data throughout the four fintech eras. From pre-industrial to medieval times, big data was created as payments moved from currency or coins to orders in negotiable instruments. Legitimizing debt permitted other instrumentation evidencing debt and enabled data informing credit scoring. In the industrial capitalism era, standardized instrumentation spawned centralized markets, deepening liquidity and making for an expanding price discovery system that improves valuation estimation. Electronic communications of that era sped up transactions by enabling electronic funds transfers, deepening markets, and contributing to

geographically standardized transactions. In the computerization era, big data enabled specialized financial intermediaries, reduced human intervention in electronic payment systems, and enabled EDI as the precursor to smart contracts. Finally, the ICT and AI era uses big data derived from all the financial service practices of prior eras. The development of crypto, AI-powered financial analysis, and disintermediated matching of counter-parties then produces big data. All these structures persist today: standardized instrumentation, centralized markets, electronic transactions communications, and the development of fintech's next generation of fintech.

(4) Compare and contrast numerical big data search and retrieval from natural language analysis.

Traditional data were numerical, requiring the intervention of human interpretation to provide useful computation and results beneficial to decision-making. Accounting professionals improved the standardization of data structures in formatting financial performance and condition data. Later formatting and data sharing standards like APIs, XML, and xBRL reduced errors and improved numerical data reliability. Natural language analysis remains a developing and difficult problem, given the nuance of meaning and its traditional requirement for human interpretation. AI holds promise to automate natural language processing. For example, ESG claims, interpretations, and refutations are difficult to process without using AI. Future fintech based on integrating numerical and natural language evidence remains in its infancy but holds great future promise.

Chapter 17: How Alternative Data Are Changing Finance

(1) Define alternative data and contrast them with traditional data used in financial forecasting.

Alternative data are not from standard financial statements or formal reports that have been traditionally done. Instead, they come from new sources and collection methods. The rise and ubiquity of technology have fostered the growth of social media, the Internet of Things (IoT), the tracking of digital footprints, and new textual, visual, and audio data methods. Respectively, these are the new sources and methods that help to generate and leverage alternative data. Traditional data in finance have typically come from formally produced information that institutions report. These alternative data and their use in financial forecasting have affected the prevalence of traditional data. This change is partly due to alternative data that capture relevant information that is not captured, or not captured as timely, in financial statements and reports. This information includes but is not limited to corporate network structures, competitor moves, regulatory changes, and brand development. The

production and regulatory costs associated with traditional data seem especially large compared to alternative data. If companies seek to leverage alternative data, there may be consequences for practitioners. These consequences would most likely concern increased emphasis on timeliness and new skill sets.

(2) Identify and discuss the sensory alternative data in the academic literature.

Although web scraping is still a burgeoning data collection method, the most common application of this method has been on text. Less common applications have involved other sensory data, such as image or audio data that can be scraped, organized, and analyzed. Various images have been scraped, analyzed, and incorporated into forecasting models. In particular, satellite imagery of commercial or economic activity has been used. For example, hedge funds use the number of cars in parking lots of major retailers to forecast sales.

Others have used photographs of analysts to assess how the facial width-to-height ratio of Chinese male sell-side analysts is associated with forecast accuracy. Various sounds and voices have been scraped, analyzed, and incorporated into forecasting models. Scraping audio files using vocal emotion analysis software during earnings conference calls has captured managerial emotion. The emotional response of firm representatives to analyst questions during conference calls can be used to forecast the firm's financial future. Similarly, the emotions embedded in the voice of the Federal Reserve Board of Governors during press conferences can be scraped and analyzed. These methods and other research have shown that vocal cues contain useful information about a market and firm fundamentals.

Monitoring the significance of the variables that are generated by monitoring individuals, such as executives or board members, will be interesting. If these individuals find out they are being monitored, they may manipulate markets more consciously using tone, word choice, and cadence. It would also be interesting to consider what data remains untapped. Biomarker and biometric data may be too invasive to consider, but new blockchain applications and the ubiquity of smart technology creating a deeper IoT seem plausibly on the horizon.

(3) Discuss how and what technology has given rise to alternative data.

Manually scraping the web and collecting the data has become antiquated due to computer programs that can automate data extraction from websites. Moreover, machine learning and textual analysis can be applied to the data from web scraping to identify sentiments, connections, and broader patterns. The physical storage of traditional data, the local storage of digital data, and the centralized storage of data have helped create an environment that fostered alternative data. Cloud computing has made storing data cheaper and easier to centralize – these

technological gains foster communication between devices. The IoT is a network of devices that is capable of exchanging data with each other. Technology embedded with sensors and monitoring devices makes up the IoT. Examples include patient implants that adjust to physiological data, agricultural devices that respond to the soil, and disaster warning systems that respond to flammable gases. Data from the IoT can be categorized into three classes: (1) status data that communicate the condition of a device or system; (2) environment data that communicate the external information of the device or system; and (3) dynamic data created by the interaction between devices and systems.

(4) Discuss the sources of cryptoasset data.

Data on cryptoassets come from several sources. Some cryptoassets have an underlying public blockchain, as opposed to private. The data on public blockchains can be downloaded from the software of a specific blockchain, for example. The Bitcoin core software stores the data for the Bitcoin blockchain. Directly querying the blockchain can generate data describing various dynamics of the blockchain, such as the mempool size or fees miners charge to gain priority in the queue. The permissions make the data on private blockchains more difficult to obtain. Still, as application developers' choices for chain infrastructure become more robust, the quantity and insight gleaned from these data will rise. For example, Depository Trust and Clearing Corp are testing a private blockchain to see whether the technology can be used to help improve the efficiency of clearing and settling transactions. If the impacts of less costly clearing are large, then larger-scale adoption of the technology would be more encouraged. Cryptocurrencies also often publish a whitepaper, have a GitHub page, and post information on social media outlining the specific details of a particular cryptocurrency. This text can be scraped to extract data. Also, data are available from secondary sources such as crypto research institutions ICObench, ICOmarks, icorating.com, smithandcrown.com, icowatchlist.com, Blockchain.com, and coinschedule.com and crypto performance tracking institutions, such as CoinMarketCap.com, Crunchbase, Crypto Fund Research.

Chapter 18: Artificial Intelligence and Machine Learning in Finance: Key Concepts, Applications, and Regulatory Considerations

(1) Using credit scoring as an illustrative use case, explain how ML methods differ from early AI methods such as "expert systems."

Credit scoring is an area where ML has significantly outperformed earlier AI methods, such as "expert systems." In the latter's case, the AI decision-making process relies on explicit rules and heuristics provided

by human experts. These rules, operating as a set of "if-then" conditions, guide the process of outcome generation by an AI system. However, this approach has limitations, particularly in handling complex and unstructured data such as that found in credit scoring. On the other hand, ML methods can autonomously learn complex patterns and relationships from empirical data, enabling them to make accurate predictions on new and unseen observations. In the context of credit scoring, ML models can process large volumes of historical financial data, identifying hidden correlations that human-designed rules might overlook. Moreover, ML models can continuously learn and adapt from new data, making them more adaptable to changing market dynamics and evolving consumer behaviors than earlier AI methods.

(2) Using algorithmic trading as an illustrative case, describe the "AI lifecycle."

In algorithmic trading, the AI lifecycle begins with identifying specific business objectives and formulating a clear problem statement. This process, for instance, involves defining key aspects, including the desired outcomes, related to the trading strategies to be implemented. Next, the AI lifecycle involves data collection and preparation, where historical market data, financial indicators, and other relevant data are gathered, processed, and refined to create a suitable dataset for training AI models. Following this step, the model development stage entails selecting appropriate ML algorithms and training the models using the prepared datasets. Subsequently, the model deployment phase comes into play, where the trained models are integrated into the trading platform, allowing them to make real-time trading decisions. The AI lifecycle continues with ongoing monitoring and maintenance, continuously evaluating the model's performance, detecting any potential drift or biases, and making necessary adjustments to ensure model effectiveness and regulatory compliance. Eventually, the entire process will discontinue or replace the concerned AI trading system or strategy.

(3) Using regtech as an illustrative use case, identify and discuss two primary risks associated with AI adoption that may impact consumer confidence.

One primary concern involves misusing personal data, where sensitive information could be mishandled or exploited, leading to privacy breaches. For instance, if AI systems are inadequately secured or lack robust data protection measures, consumers' personal and financial information might become vulnerable to unauthorized access or cyberattacks. Whenever this risk occurs, consumer trust in regtech deteriorates.

Another critical risk is associated with the lack of transparency in AI. When consumers cannot understand how AI algorithms arrive at specific decisions or recommendations, this situation can create a sense of uncertainty and apprehension among them. In cases where AI-generated outcomes impact crucial financial decisions or hinder regulatory

compliance, the lack of transparency may lead consumers to question the validity and fairness of these outcomes. Inadequate transparency may thus diminish consumer confidence in the reliability and legitimacy of regtech systems.

(4) Identify the main differences among emerging regulatory approaches to AI governance.

AI governance approaches vary substantially, reflecting different balances between policymakers and industry players in regulation. Some jurisdictions favor public regulation by government bodies and public institutions, while others rely more on market self-regulation. The various emerging regulatory approaches have different priorities, from consolidating economic positions to promoting innovation and protecting fundamental rights. For instance, China employs a centralized, state-led strategy, while the United States, the United Kingdom, and Singapore adopt a pro-innovation stance with minimal regulatory intervention. In the European Union, the recently agreed AI Act follows a rights-based perspective, aiming to horizontally regulate all AI systems that may threaten individuals' safety and fundamental rights. Although the optimal approach to AI regulation may not exist, there is a growing consensus that, given the many risks involved, more robust regulation is needed to ensure effective AI governance.

Chapter 19: Insurtech: Disrupting the Insurance Industry

(1) Define insurtech.

Insurtech refers to any innovation boosted by technology that creates value in the insurance sector by delivering data-driven and customer-oriented solutions in a digital landscape.

(2) Identify the driving capabilities in transforming the insurance sector.

The driving capabilities that have been instrumental in boosting innovations in the insurance sector represent the technological capabilities for applying innovation in this sector. The potential of the five driving capabilities in transforming the insurance sector has arisen from the combination of the innovations. These capabilities are:

- *Implementing digital capabilities.* Focused on implementing digital infrastructures through its technological capacity to establish infrastructures (IaaS), software (SaaS), and digital platforms (PaaS).
- *Providing data-driven solutions.* Focused on data-driven operations, applying innovation through its technological capability to extract, analyze, exploit, and evaluate risk-related data.
- *Integrating services and customer experience.* Focused on the complementary proposal of services in the insurance sector, improving interaction and customer experience.

- *Creating and developing a digital insurance offer.* Focused on developing an insurance offer in response to consumer needs and adapting the offer according to specific customer demands.
- *Offering digital insurance distribution.* Focused primarily on distributing insurance through digital delivery systems so customers can research, compare, and purchase insurance online without manual or physical support.

(3) Discuss how insurtech has transformed the value configuration in the insurance industry by evolving from a value chain to a value network.

Insurtech's disruptive potential has transformed the insurance industry's structure and altered and disrupted the insurance value configuration by describing an ecosystem characterized by collaboration, innovation, and co-creation. Specifically, this new value configuration has been evolving from a traditional linear value chain, in which each participant adds value to the product or service before passing it on to the next participant, to a more dynamic and interconnected value network, in which participants collaborate and share resources to create new value propositions for customers. Overall, this new paradigm represents a fundamental transformation in how insurance products are designed, distributed, priced, underwritten, and serviced.

(4) Explain the waves resulting from the insurance industry transformation driven by insurtech's impact.

The insurance industry's transformation has resulted from three waves of change driven by insurtechs. The first wave was characterized by the emergence of insurtech, which disrupted traditional business models by leveraging technology innovations to improve customer experience, reduce costs, and increase efficiency. This wave focused on improving the value chain's operational workflows and work processes. The second wave was characterized by enablers, often inspired by new challengers, who concentrated on helping incumbents improve specific parts of the value chain or even helping them create new ones by creating a full range of protection products, covering new risks with new uses, and creating new insurance products. The third wave is expected to be driven by ecosystem players who leverage their network effects and data-driven capabilities to develop more collaborative and open environments where participants can share information, resources, and capabilities to co-create value for all parties involved.

(5) Discuss the opportunities in the insurance industry's current landscape.

The insurance industry's current landscape presents a capability dilemma due to the disruption caused by insurtech. Furthermore, data analytics has become pivotal, requiring insurers to invest in advanced tools to understand customers and personalize offerings. Balancing traditional strengths with investments in new capabilities is vital for insurers to thrive. Therefore, the insurtech ecosystem offers opportunities

for insurers to partner with startups, enhancing their capabilities and meeting customer demands in a rapidly evolving market.

Chapter 20: Revolutionizing the Real Estate Industry With Fintech

(1) Describe the underwriting of a borrower requesting a residential mortgage loan and how technology increases the speed and accuracy of the process.

When considering providing mortgage funds in a residential transaction, lenders underwrite the borrower and the property. The factors of this underwriting process include income and job history, credit history, down payment, property value, and qualifying ratios. The application of technology to each process can add speed and accuracy to data, process automation, and business logic, varying by activity.

- *Income/job history and credit history.* Electronic records make the data collection relatively simple. Data sources include US tax forms, FICO credit scores, and electronically executed employer verification forms.
- *Down payment.* Lenders are concerned with borrowers having sufficient "skin in the game" and money at risk in the real estate transaction. The secondary mortgage market also requires specific loan-to-value (LTV) standards, such as 80% LTV per the Fannie Mae guidelines, thus requiring a borrower to have a 20% down payment. However, to ensure that the 20% down payment is the borrower's saved funds rather than another form of debt in some way, electronic verification from the borrower's savings account can be accessed readily.
- *Property value.* If a lender will lend 80% LTV, the obvious question is − what is the value part of this equation? For lending purposes, value is established using a third-party appraiser who follows a specific, consistent process. Such processes include data collection and business logic that have been automated via tools such as Apprize for a more formal appraisal and Zillow for an estimate, all of which apply business logic driven by good data.
- *Qualifying ratios.* Lenders are concerned with a borrower's ability to repay a mortgage loan based on a monthly payment of principal, interest, taxes, and insurance (PITI). These ratios usually range from 28%/36%, where a borrower can use up to 28% of their monthly income toward PITI or up to 36% of their monthly income toward PITI plus all other long-term debt payments. Technology can easily automate this process and apply business logic if the lender has robust data on the borrower's income and debt.

(2) Describe the process of appraising a residential home value for a mortgage loan, including sources of data and business logic technology tools.

A residential home appraisal follows a specific standard process established by lenders and the secondary mortgage market to create confidence that the value stated is true market value. The steps an appraiser follows include obtaining data, following a process, and applying business logic, which are now being conducted through AI-type technologies such as Apprise and Zillow.

The appraisal process includes:

- Determine the purpose of the appraisal. In this case, the purpose is a residential mortgage loan.
- Determine the scope: How will the appraisal be conducted?
- Collect market data.
- Analyze the data. What is the property's highest and best use (i.e., maximum value)?
- Determine the land value. Use the comparable sales method.
- Apply three valuation techniques: the income, comparable sales, and cost approaches.
- Reconcile the three valuations. Use judgment to weigh the appropriate approaches.
- Report the final value estimate.

(3) Explain how an income property is valued using cap rates and what areas of automation can assist investor decision-making.

Income property is valued using various techniques, all of which are amendable to good technology automation of business logic. The most common value technique is the use of the cap rate formula:

$$\text{Value} = \text{NOI}/\text{Cap rate}$$

This formula capitalizes a property's first year's net operating income (NOI) to establish the value. NOI is the amount of cash flow generated by a property each year by taking the property's gross rental income and deducting the costs to operate the building across maintenance, taxes, and insurance, which is called operating expense.

The cap rate is often described as a risk-adjusted rate of return and historically trends with mortgage rates. Cap rates tend to be 150–200 basis points higher than mortgage rates, thus allowing investors to leverage the yield on their equity investment. In short, if one can borrow mortgage debt at 6% and invest it at an 8% cap rate in an investment property, the effective yield on one's remaining equity investment is increased.

Technology plays a role in this process by improving market data availability for the potential rental income and value of investment properties. Companies such as CoStar and Loopnet, while not substitutes for the equivalent multiple list service (MLS) available in the residential

world, provide good data on prices, values, market cap rates, and rental income.

(4) Discuss the complexity of commercial real estate data needs, gaps, and how business logic depends on clean data.

Commercial real estate is a complex practice area compared to residential real estate. Commercial real estate involves the business strategy and income of companies who occupy the property. Investors in these same properties base their decisions on the property's NOI, driven by the occupiers' demand and resultant NOI for such real estate. Complexity can be seen in occupier decision-making across location, access to labor, transportation, competition, proximity to customers, and issues of taxes and regulation specific to that property.

These issues have the potential to benefit from strong AI and data tools to resolve data needs, process automation, and business logic in the site selection, pricing, term of occupancy, and the own versus lease decision. Tools such as Tango Analytics are at the edge of bringing together the process part of these needs. Cherre, Deepblocks, and other technology tools seek to obtain, standardize, and resolve data while adding business logic. In the case of Deepblocks, looking at land parcels and considering zoning, setbacks, and building standards, one can answer the question, "What can be built there?"

The data needs are challenging in this environment as the United States does not have national zoning, building codes, and other regulations. Local governments create many regulations and standards and then store and report them differently. Data become the limiting factor in this practice, rather than process automation or business logic, as the semantic consistency of these data points and where the data reside (cloud, server, where?) creates challenges to have clean, strong, usable data.

Chapter 21: Fintech in Capital Markets

(1) Explain why fintech is often credited with democratizing capital markets.

Some credit fintech for its role in democratizing capital markets by increasing capital market accessibility, particularly for retail investors. Innovations such as online brokerages and robo-advisors have dismantled traditional entry barriers by allowing more individuals to trade securities in capital markets easily and cheaply. Users can access professional strategies without extensive financial knowledge by offering automated investment guidance. Additionally, online peer-to-peer markets facilitate direct lending and borrowing, bypassing traditional institutions and promoting financial inclusion. These fintech solutions empower individuals, fostering a more inclusive and accessible financial ecosystem.

(2) Discuss so-called high-frequency trading algorithms and how their increasingly widespread use affects capital markets.

High-frequency trading algorithms are computer-based trading strategies that rely on various features, such as ultra-low latency systems, designed to execute many trades within extremely short timeframes, typically in the range of milliseconds. Their increasingly widespread use has mixed effects on markets. On the positive side, the algorithms' high trading volume increases market liquidity, and their ability to allow traders to include new information in prices instantaneously benefits pricing efficiency. On the negative side, the algorithm's trading style can exacerbate market volatility and potentially contribute to flash crashes.

(3) Explain how ML-based data analysis has affected capital markets, particularly when applied to big data.

ML-based data analysis, particularly involving big data, is important in enhancing capital market pricing efficiency. By using the technology, market participants can identify new patterns or trends in data faster, making more informed investment- and trading decisions. This situation is especially true if the analyzed data were previously unavailable or could not be analyzed manually or with legacy software due to its size, complexity, and lack of structure. One specific example is the real-time analysis of satellite imagery data to forecast economic conditions by, for example, observing activity in major trading hubs such as ports. These real-time capabilities of big data analysis allow markets to instantly incorporate relevant information in securities prices instead of waiting and trading on the release of outdated ex-post information. Therefore, market efficiency is greatly improved.

(4) Discuss capital markets' challenges in adopting blockchain technology in securities clearing and settlement processes.

Despite blockchain's many potential benefits, this technology can only be adopted successfully for back-office tasks in capital markets if some challenges can be overcome. First, users must settle on a single blockchain technology and agree on its governance model. Second, latency and scalability issues that arise from consensus algorithms and cryptographic verification can cause delays, which might impede markets' drive for ever-faster trade execution, clearing, and settlement processes. Third, classic intermediaries will remain necessary for certain market functions, such as margin accounts, meaning that blockchains cannot fully eradicate the need for intermediaries. Fourth, the desired level of decentralization poses questions, as proof-of-stake methods may concentrate power with large entities. Capital markets efficient solutions that consider governance, scalability, and the role of intermediaries.

(5) Explain why initial coin offerings have faced regulatory backlash.

Regulatory concerns pose a major challenge to ICOs, particularly concerning the tokens issued in the ICOs for fundraising purposes. These

tokens are typically structured like equity and may be classified as securities under the Howey Test, triggering SEC registration and regulation. A 2020 landmark ruling in a U.S. district court supported the SEC's position, prohibiting Telegram's sale of unregistered tokens and resulting in a substantial settlement. The SEC's intention to pursue similar cases indicates a commitment to regulating token sales. Although this commitment protects investors from fraudulent activities, it also increases complexity and costs, making token sales less attractive than IPOs.

Chapter 22: Technologies and Emerging Trends Shaping Fintech

(1) Define the term green bonds.

A green bond is a type of bond used to fund projects that have a positive environmental impact. Corporations, municipalities, sovereign countries, and financial institutions typically issue green bonds. By investing in green bonds, investors sensitive to environmental issues can support environmentally friendly projects while earning a return on their investment.

(2) Identify and discuss ESG integration.

ESG integration incorporates ESG factors into investment decisions and corporate strategies. Through ESG integration, investors can pinpoint and navigate risks tied to ESG challenges, such as extreme climatic events, limited water resources, and carbon emissions, that present environmental threats. By embracing ESG integration, investors can evaluate these hazards and make enlightened investment choices. Companies with strong ESG performance may be better positioned to manage risks and capitalize on opportunities. A successful ESG program can help companies access vast pools of capital from investors looking for ESG-friendly investments. A growing demand exists for financially sound and ethically aligned investments, especially among millennials.

(3) Identify and discuss carbon trading and carbon credits.

Carbon trading is a market-based buying and selling of permits that allow a company to emit a certain amount of carbon dioxide or other greenhouse gases. Governments and regulatory bodies authorize these carbon credits to reduce overall carbon emissions and mitigate their contribution to climate change. One credit permits the emission of one ton of carbon dioxide or the equivalent of other greenhouse gases. By paying someone else to reduce their emissions or capture their carbon, companies can compensate for their environmental footprint and even use carbon credits to get to carbon-neutral status in the most ambitious cases.

(4) Discuss neobanks and their sustainable characteristics.

Neobanks are exclusively digital financial institutions functioning without brick-and-mortar branches, delivering their services via online and mobile channels. Many neobanks emphasize sustainability and ethical approaches, integrating ESG factors into their strategies and choices. This ESG integration entails assessing how their actions influence the environment and society and advocating for sustainable progress using responsible lending and investment strategies. Neobanks with sustainable characteristics aim to balance their financial goals with their responsibility to contribute to sustainable development and the well-being of society. By prioritizing sustainability, these neobanks are helping to drive positive change and promote a more sustainable future.

Chapter 23: The Future of Fintech: Challenges and Opportunities

(1) Discuss the impact of the COVID-19 pandemic on fintechs.

Because people were shut in and unable to do their everyday business during the COVID-19 pandemic, they were forced to look for alternatives to carry out daily tasks. Consumers can use fintech applications to do many financial tasks online. Many unbanked and underserved people worldwide signed up for accounts during the pandemic, leading to mass adoption of the products and services.

(2) Explain why artificial intelligence (AI) and machine learning (ML) are essential to fintechs.

Fintech firms, banks, and many other companies expect AI and ML to speed up cost savings as they allow firms to accomplish tasks with fewer people and less time. AI and ML also assist firms in detecting fraud, money laundering, and cyberattacks more quickly and at a lower cost than those that do not use these technologies. Firms can also use the technologies to analyze data and offer more personalized financial services to companies.

(3) Identify the main opportunities available to fintechs.

Fintechs have many opportunities available to them, including the following:

- *Incorporating embedded finance.* Embedded finance includes embedding financial solutions into product offerings that are not financial, such as online purchases of everyday items.
- *Using digital currencies, blockchain, and decentralized finance.* Fintechs can develop innovative solutions using blockchain in payments, lending, and security.
- *Adopting AI and ML.* AI and ML will help companies understand their customers better and create personalized financial services targeted at individual customers.

- *Making finance more inclusive by offering services with little or no fees.* Fintechs can more easily reach out to traditionally underserved countries and consumers.
- *Entering new sectors such as regtech (regulatory technology), insurtech (insurance technology, and others).*

(4) Identify the main challenges facing fintechs.

   The main challenges facing fintechs are complying with ever-changing regulations, protecting against cyberattacks and money laundering, managing the risks associated with relying too heavily on venture capital and the same technology stacks used by competitors and keeping data secure. Firms must also be able to attract and retain talent and new customers.