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Distributed Ledger Technology and the Securities Markets of the Future: A Stakeholder Survey

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DISTRIBUTED LEDGER TECHNOLOGY AND THE SECURITIES MARKETS OF THE FUTURE: A STAKEHOLDER SURVEY

Merritt B. Fox,* Lawrence R. Glosten,** Edward F.
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This Article evaluates the implications of distributed ledger technology (DLT) for the securities markets of the future and their regulation. DLT is an integral part of the larger revolution in computing, communication and data storage capacity that has transformed securities markets over the last few decades and promises further radical change in the years to come. The potential of DLT, if it can be realized, could improve the functioning of our securities markets while at the same time sharply reducing costs. Based on an interview survey of about 100 persons who play prominent roles in actually making these markets work or in regulating them, this Article reports on the most important topics and themes that have emerged from the wide range of interviewees' opinions about the extent to which DLT will affect the future of securities markets and their regulation. A significant number saw the

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potential for DLT to transform securities markets and market structure, from the possibility of stock trading on DLT to the potential impact on intermediaries, the ordinary retail investor, and on preventing wrongdoing in the stock market. However, key questions remain about implementation and the appetite for making DLT-based changes among both market participants and regulators.

I.	Introduction	653
II.	The Survey	656
III.	The Overall Potential of DLT	659
IV.	Public Trading and Offering of Stocks on DLT?	660
	A. Potential Advantages	660
	B. Views of Interviewees as to the Potential for Trading and Offering Stock Using DLT.....	663
	C. Problems Implementing DLT-Based Systems for Securities	665
	D. Summation and Questions Going Forward	670
V.	Market Structure	670
	A. Fees for Proprietary Data	671
	B. Rebates and User Fees	674
	C. Order Protection Rule	675
	D. Fragmentation.....	676
	E. Special Regulatory Status of the Stock Exchanges	678
	F. The Technological Arms Race	679
	G. The Quality of the Market for Large Issuer Stocks Versus that for Smaller Issuer Stocks	680
	H. Debt Markets.....	681
	I. Summation and Questions Going Forward	682
VI.	Public Versus Private Markets.....	682
	A. The Potential Impact of DLT on the Relative Size of Private Versus Public Markets	684
	B. Issues Related to the Public/Private Market Divide	687
	C. Summary and Questions Going Forward	690
VII.	The Ordinary Investor	691
VIII.	Intermediaries	696

A.	The Shrinking Role of Brokers for Ordinary Investors	696
B.	Redefinition of Duties.....	697
C.	Conclusion	698
IX.	Wrongdoing.....	699
X.	Digital Coins	701
XI.	Regulatory Learning.....	702
XII.	Conclusion.....	706
XIII.	Appendices	706
	Appendix A: June 25, 2019 Roundtable Attendees... ..	706
	Appendix B: Survey Interviews Conducted to Date..	707
	Appendix C: Questions Sent Stakeholder Survey Interviewees in Advance.....	710

I. INTRODUCTION

Information and securities markets have always been tightly intertwined. Over history, progress around the communication and processing of information has brought successive transformations in how these markets operate.¹ With each of these transformations has come a new set of regulatory challenges and opportunities.²

Today, there is much excitement around the latest manifestation of the information technology revolution: distributed ledger technology (DLT). DLT is an integral part of the larger revolution in computing, communication, and data storage that has totally remade securities markets in recent decades³ and promises further radical change in the

¹ See Dan Awrey & Kathryn Judge, *Why Financial Regulation Keeps Falling Short*, 61 B.C. L. REV. 2295, 2302–08 (2020) (outlining the dynamic nature of financial markets); see also generally U.S. SEC. & EXCH. COMM’N, THE IMPACT OF RECENT TECHNOLOGICAL ADVANCES ON THE SECURITIES MARKETS (1997), <https://www.sec.gov/news/studies/techrp97.htm> [<https://perma.cc/9CK7-QFQB>] (discussing the effect of technological advances on the securities market).

² See *supra* note 1.

³ See generally MERRITT B. FOX, LAWRENCE R. GLOSTEN & GABRIEL D. RAUTERBERG, *THE NEW STOCK MARKET: LAW, ECONOMICS, AND POLICY* (2019).

years to come.⁴ A distributed ledger is a data base that is shared across many individual computers, with each having an identical copy of the ledger.⁵ Each change in the ledger is verified by some kind of consensus protocol without the involvement of a central authority.⁶ The blockchain is a kind of digital ledger.⁷ For many kinds of transactions, DLT has the potential to eliminate the need for a trusted intermediary, assure compliance to agreed terms, and keep a traceable record.⁸ This potential, if it can be realized, could improve the functioning of our securities markets while at the same time sharply reducing costs.

What are the implications of DLT for the securities markets of the future and their regulation? One way to try to address this question is to gather and assess the thoughts of the wide range of persons who play prominent roles in actually making these markets work or in regulating them. This Article reports on an effort to do just that and is based on an interview survey of about 100 such persons. Such a survey can be informative for a number of reasons. One, of course, is that people who have a direct stake in how our securities markets operate, and who have experience with them in a hands-on way every day, can provide insights and knowledge not easily accessible by scholars in other ways. The survey can also be useful to help understand the political economy of these markets and their regulation, and to sharpen our understanding of the various goals that securities regulation seeks to serve and the tradeoffs among them. Changes that

⁴ See generally SECURITIES MARKET ISSUES FOR THE 21ST CENTURY (Merritt B. Fox et al. eds., 2018).

⁵ For a discussion of the different ways DLT has been defined, see MICHEL RAUCHS ET AL., CAMBRIDGE CTR. FOR ALT. FIN., UNIV. OF CAMBRIDGE, DISTRIBUTED LEDGER TECHNOLOGY SYSTEMS: A CONCEPTUAL FRAMEWORK 19–20 (2018), <https://www.jbs.cam.ac.uk/wp-content/uploads/2020/08/2018-10-26-conceptualising-dlt-systems.pdf> [<https://perma.cc/6S7T-DFKK>].

⁶ *Id.* at 24.

⁷ See *id.* at 25–27; Ryan J. Davies & Erik R. Sirri, *The Economics of Trading Markets*, in SECURITIES MARKET ISSUES FOR THE 21ST CENTURY, *supra* note 4, at 145, 203–04.

⁸ See Davies & Sirri, *supra* note 7, at 203–06.

could be brought by DLT, like so many other changes that information technology has been bringing to the markets in recent years, would substantially disrupt how business is done. As in any regulated industry, that disruption would force regulators to adapt, prompting an inevitable reexamination of the goals of the regulatory system.⁹ If such a disruption occurs, it will bring to the fore underlying conflicts among the different types of market participants that have just simmered in the background when debates have only involved more minor changes in established ways of doing business. More idealistically, such a disruption could remake the world anew from a regulatory and business point of view. All of this means that an intelligent discussion of the implications of DLT for the securities markets requires an understanding not only of the technology and its possible securities market applications, but also of what different types of market participants think the goals of securities regulation should be and how they think those goals should be met.

This Article proceeds as follows. Part II provides some background concerning the survey and information on how it was conducted. Parts III through XI summarize and assess the most important topics and themes that have emerged from the interviews. Part III discusses the overall potential of DLT broadly conceived. Part IV considers the possibility of stock trading on DLT. Part V relates to market structure concerns. Part VI considers the impact of DLT on the division of activity between private and public markets for securities. Part VII considers the possible impact of DLT on the ordinary retail investor. Part VIII considers its potential impact on the role of intermediaries. Part IX considers how DLT-based changes might provide opportunities for both undertaking and preventing wrongdoing in the market, and Part X considers digital coins. Finally, Part XI focuses specifically on regulatory responses to DLT-based changes.

⁹ See Awrey & Judge, *supra* note 1, at 2320–21.

In this review of the survey's results, we will see that the interviewees expressed a wide range of opinions about the extent to which DLT will affect the future of securities markets and their regulation. A significant number saw the potential for DLT to transform securities markets, but key questions remain about implementation and the appetite for making DLT-based changes among both market participants and regulators.

II. THE SURVEY

The Columbia Law School/Columbia Business School Program in the Law and Economics of Capital Markets has been conducting interviews using its Stakeholder Survey since the summer of 2019. This is an interview-based survey of a wide range of stakeholders in the securities markets. The interviewees include domestic and international regulators, relevant persons from securities-issuing corporations, securities-trading venues of different types, broker-dealer firms, institutional investors, retail investor protection organizations, securities law firms, blockchain entrepreneurs, technology and financial institutions utilizing new DLTs, and academics whose thinking is driving the field forward. The Stakeholder Survey is part of the Program's New Special Study of the Securities Markets, a multi-year, comprehensive, from-the-ground-up examination of the securities markets and their regulation.¹⁰ The Survey's purpose is to gain a deeper understanding of the specific legal and economic issues

¹⁰ The New Special Study of the Securities Markets is patterned after the original Special Study completed in 1963, which had a huge influence over the development of the securities laws for several succeeding decades. *See generally* Report of the Special Study of the Securities Markets of the Securities and Exchange Commission, H.R. DOC. NO. 88-95 (1963). The goal of the new study is to make securities regulation reform more proactive and less reactive, much as the original study did. *See The New Special Study of the Securities Markets*, COLUM. L. SCH.: THE PROGRAM IN THE L. & ECON. OF CAP. MKTS., <https://capital-markets.law.columbia.edu/content/new-special-study-securities-markets> [<https://perma.cc/3WMB-RLVD>] (last visited Feb. 24, 2021).

that these stakeholders consider to be most critical to the market's regulation. In particular, the Survey explores what regulatory changes each respondent regards as most needed and why. Understanding the impact of DLT on the securities markets and their regulation will inevitably be a critical part of the mission of the larger New Special Study Project, so this has been a special focus of the Stakeholder Survey. This Article reports on what this focus has uncovered.¹¹

As a starting point, the Program organized a Roundtable in June 2019 to test and discuss a set of draft questions to be included in the Survey. With backgrounds in law, finance, and computer science,¹² the participants focused on how data, blockchain, and smart contract technologies are affecting economics, law, and policy in the securities markets. The Roundtable was critical in shaping the Survey, helping to determine who would be interviewed and the questions they would be asked.

Following the Roundtable, interviews began late in the summer of 2019 and have been conducted with about 100 persons. On the regulatory side, these have included nine current or former SEC Commissioners, including three former Chairs or Acting Chairs of the Commission, the head of the Brazilian Comissão de Valores Mobiliários (“CVM”—the Brazilian equivalent to the SEC), the former Chair of the Committee of European Securities Regulators, and the CEO of FINRA. On the private side, the interviewees included the heads of some of the largest trading venues as well as the former CEO of the management company of one of the world's largest mutual fund families. We also interviewed many persons with key operating responsibilities on the regulatory and private

¹¹ The Stakeholder Survey and its particular focus on DLT has been assisted by a generous grant from the Columbia-IBM Center for Blockchain and Data Transparency. See *Understanding Blockchain Technology's Impact on the Securities Markets*, COLUMBIA-IBM CTR. FOR BLOCKCHAIN AND DATA TRANSPARENCY (June 12, 2019), <https://cu-ibm-blockchain-data.columbia.edu/news/blockchain-technology-securities-markets> [https://perma.cc/F5C4-GRVL].

¹² The attendees at the Roundtable are listed in Part XIII app. A.

side, among them a number of lawyers and economists with firsthand knowledge of the securities markets. The full list and their positions at the time of the interview are listed in Appendix B.

Each interview lasted approximately an hour. Each interviewee was sent a list with a wide range of potential questions, attached as Appendix C, but the interview itself was conducted in an open-ended, discursive fashion in order to take full advantage of each interviewee's specific expertise and to solicit the particular insights they had to offer. The interviews were recorded for our own purposes, but the interviewees were told these recordings would not be made public and that they would not be quoted by name or in some other easily identifiable way. When interviews began in the summer of 2019, the U.S. economy was experiencing robust growth,¹³ and our interviews reflected thoughts about the world as it existed then. The world has, of course, changed drastically since, including the sharp Spring 2020 decline in equity prices and subsequent recovery,¹⁴ the severe Spring 2020 difficulties in the short-term corporate credit market,¹⁵ the continued economic downturn with its severe damage to certain sectors of the economy,¹⁶ and the remarkable COVID-

¹³ See Sarah Chaney, *Strength in U.S. Consumer Spending Drives Economy*, WALL ST. J. (Aug. 30, 2019, 1:41 PM) (on file with the Columbia Business Law Review), <https://www.wsj.com/articles/u-s-consumer-spending-rose-sharply-in-july-11567168319>.

¹⁴ See Akane Otani, *Covid-19 Fueled Stock Market Selloff Last Year. Here Are Some Lessons Learned.*, WALL ST. J. (Mar. 7, 2021, 5:30 AM) (on file with the Columbia Business Law Review), <https://www.wsj.com/articles/covid-19-crashed-the-stock-market-a-year-ago-here-are-some-lessons-learned-11615113001>.

¹⁵ See Matt Wirz, *Short-Term Bond Market Roiled by Panic Selling*, WALL ST. J. (Mar. 18, 2020, 10:43 AM) (on file with the Columbia Business Law Review), <https://www.wsj.com/articles/short-term-bond-market-roiled-by-panic-selling-11584542633>.

¹⁶ See Gwynn Guilford, *U.S. Unemployment Claims Reach New Covid-19 Pandemic Low*, WALL ST. J. (May 6, 2021, 11:56 AM) (on file with the Columbia Business Law Review), <https://www.wsj.com/articles/weekly-jobless-claims-coronavirus-05-06-2021-11620247798> (noting that employment numbers, though improved, remained low even in May 2021).

19-imposed switch to remote work for most people involved in the securities markets.¹⁷

III. THE OVERALL POTENTIAL OF DLT

Multiple interviewees said using DLT in the securities markets might have significant benefits. These could include lower clearing and settlement costs, an indelible and unified record of transactions that would make it far easier for enforcement officials to survey and trace transactions in order to detect and prove violations, enhanced data privacy and monitoring capabilities, and, as discussed below, even a platform for trading at least some, and perhaps all, stocks.¹⁸ Broadly speaking, as one member of the broker-dealer community put it, anything that reduces the costs and enhances the operational effectiveness of the securities markets' payments system is inherently valuable. Another member of the regulatory community said blockchain might generally be used to make recordkeeping more efficient and for avoiding the expense of a trusted intermediary where one would otherwise be necessary.

Yet, just as frequently, interviewees expressed substantial concerns about whether the markets and regulators were ready for DLT. As one member of the regulatory community stated, fully functioning DLT-based markets would require near-universal adoption of DLT, which seems very unlikely unless regulators come up with a long-term plan for creating incentives to adopt it and guidance on implementing it.

Misgivings about whether implementation would in fact, on balance, be positive also emerged as a theme in many of the interviews. As one interviewee pointed out, even if right now DLT could facilitate audit trails and recordkeeping, an entity would still be needed to bring buyers and sellers

¹⁷ See Kate Kelly, *Dust Off Desks and Boot Up Terminals: Wall St. Returns, Fitfully*, N.Y. TIMES (Sept. 23, 2020) (on file with the Columbia Business Law Review), <https://www.nytimes.com/2020/09/23/business/wall-street-return-to-office.html>.

¹⁸ See *infra* Part IV.

together, and using DLT to create a trading platform that would substitute for a stock exchange is a much more ambitious task. Interviewees also commonly noted the obstacles of scaling up the functionality of DLT for widespread use as a trading and clearance and settlement platform in the equities markets, where a huge volume of transactions occurs every minute.¹⁹

IV. PUBLIC TRADING AND OFFERING OF STOCKS ON DLT?

Publicly trading and offering stocks on DLT would have a number of advantages. But how practical would it be? Much depends on the scalability of DLT and the market's and regulators' appetite for a more disintermediated system. Nor is it obvious that there is any way for DLT to perform the function currently performed by exchanges and other trading venues in bringing together prospective buying and selling interests so that they can find each other.

A. Potential Advantages

In the current system of trading stocks publicly on an exchange or through another venue, a buyer and a seller anonymously agree to transact a given number of shares for a given price.²⁰ Then, two days later, the promised money is exchanged for the promised stock in what is known as clearing and settlement.²¹ It is critical for the functioning of this anonymous market that buyers and sellers feel confident that

¹⁹ For example, over a ten-day period in early May 2021, the New York Stock Exchange alone processed an average of 4,918,695 trades per day, or over 3,400 per minute. See *U.S. Equities Market Volume Summary*, NASDAQ (on file with the Columbia Business Law Review), <https://www.nasdaqtrader.com/trader.aspx?id=FullVolumeSummary> (last updated May 14, 2021) (click "Trades").

²⁰ See FOX ET AL., *supra* note 3, at 20.

²¹ On this process, see Securities Transaction Settlement Cycle, 82 Fed. Reg. 15,564, 15,564–69 (Mar. 29, 2017) (codified at 17 C.F.R. § 240.15c6-1 (2020)).

their deals will be honored. Currently, this confidence is established by a complex system that requires every buyer or seller to place its order through a broker who then acts as a backup should its customer fail to perform.²² The system in turn includes a clearing and settlement system whereby other brokers, in essence, back up the customer's particular broker in case the broker itself fails.²³ It is in clearing and settlement that the actual exchange of stock for money occurs.²⁴

The most optimistic interviewees believe that a DLT-based system could both perform the function of the trading venue—matching potential buyers and sellers who could directly submit their orders to it—and then instantaneously provide for the exchange of stock for money. This could generate substantial cost savings. Brokers, the exchanges, and the clearing and settlement entity would no longer be necessary and making the exchange of stock and money instantaneous would free up the capital currently required to back a two-day lag.²⁵

The DLT system could also manage each corporation's stock ledger more efficiently. Unlike today's system, which promotes easy trading by making broker-provided nominees the record holders of most stock,²⁶ DLT would identify the actual beneficial shareholders at any given moment.²⁷ This would simplify distribution of dividends and required shareholder notifications and bring order to the currently chaotic system of shareholder voting.²⁸ Many of these

²² See FOX ET AL., *supra* note 3, at 20.

²³ See Securities Transaction Settlement Cycle, 82 Fed. Reg. at 15,567.

²⁴ See FOX ET AL., *supra* note 3, at 264.

²⁵ On this use of capital, see Securities Transaction Settlement Cycle, 82 Fed. Reg. at 15,569–71.

²⁶ For a recent summary of this system, see Brandon Ferrick, Note, *Modernizing the Stockholder Shield: How Blockchains and Distributed Ledgers Could Rescue the Appraisal Remedy*, 60 B.C. L. REV. 621, 626–31 (2019).

²⁷ See Davies & Sirri, *supra* note 7, at 203–06.

²⁸ See, e.g., generally George S. Geis, *Traceable Shares and Corporate Law*, 113 NW. U. L. REV. 227 (2018) (discussing DLT and shareholder voting).

advantages, on a one-time basis, would also accompany public offerings of stocks utilizing DLT. And doing an offering in this fashion would lay the groundwork for the secondary trading of the stock to be DLT-based, as well.²⁹

²⁹ Recent pilot projects involving the primary offering or secondary trading of very specific securities suggest that the hopes of those imagining wide-spread DLT-based offerings and trading are not entirely fanciful. *See, e.g.*, Press Release, Vanguard, Vanguard Advances Blockchain Technology Pilot To Streamline Asset-Backed Securities Markets (June 11, 2020), <https://pressroom.vanguard.com/news/Press-Release-Vanguard-Advances-Blockchain-Technology-Pilot-061120.html> [<https://perma.cc/JFH3-P464>] (“Vanguard, in partnership with technology provider Symbiont, announced today the completion of the first phase of a blockchain pilot designed to digitize the issuance of asset-backed securities (ABS). In close collaboration with a large US ABS issuer, as well as BNY Mellon, Citi, and State Street, Vanguard successfully modeled the full lifecycle of an ABS settlement on [a] distributed ledger technology (DLT) network by replicating end-to-end transaction flows.”); *SIX Digital Exchange Launches DLT-Based Trading and Settlement Prototype*, FINEXTRA (Sept. 23, 2019), <https://www.finextra.com/newsarticle/34460/six-digital-exchange-launches-dlt-based-trading-and-settlement-prototype> [<https://perma.cc/86S2-XYHG>] (“Swiss stock exchange SIX has launched a prototype of its distributed ledger technology-based digital exchange and central securities depository. Meanwhile, trading has started on Boerse Stuttgart Digital Exchange.”); Press Release, Societe Generale, Societe Generale Issued the First Covered Bond as a Security Token on a Public Blockchain (Apr. 23, 2019), <https://www.societegenerale.com/en/newsroom/first-covered-bond-as-a-security-token-on-a-public-blockchain> [<https://perma.cc/ZSA4-ZTVG>] (“On 18 April 2019 Societe Generale SFH, a subsidiary of Societe Generale Group, issued EUR 100m of covered bonds . . . as a security token, directly registered on the Ethereum blockchain.”); Joseph Lubin et al., *The Role of CSDs and Ethereum in Decentralized Finance*, CONSENSYS (Apr. 2019), <https://pages.consensys.net/advancing-capital-markets-with-blockchain-technology> [<https://perma.cc/ZF2Q-VEXS>] (“In April of this year, CapBridge announced 1exchange (1X), a private securities exchange built on the public Ethereum blockchain in collaboration with ConsenSys and regulated by the Monetary Authority of Singapore. 1X will tokenize securities, creating an immutable digital representation of investments on the blockchain that are easier, cheaper, and more secure to manage. Moreover, the standardization and universality of public Ethereum mainnet ensures 1X is aligning itself to a growing, global, borderless liquidity pool—positioning itself to connect with other blockchain-based exchanges in the future. 1X will provide optimized tracking ability of securities traded on its platform by investors.

B. Views of Interviewees as to the Potential for Trading and Offering Stock Using DLT

A number of interviewees raised the possibility of trading stock on blockchain technology. For example, one member of the regulatory community believes that the ability to use blockchain for detailed audits without intermediaries could persuade markets to trade stock on blockchain technology. Several legal practitioners suggested that DLT can enable the tracing of changes in share ownership after a direct listing transaction or a secondary offering. This would solve the problem of attaching section 11 liability, with its power to deter registration statement misstatements, to any purchases of an issuer's shares after it has engaged in a direct listing or to any share offered in a seasoned offering that has been traded in the secondary market by the time the misstatement has been discovered.³⁰

Even if moving all publicly traded stocks to an exclusive DLT platform proves impractical in the near future, one member of the regulatory community raised a narrower

Additionally, investors will have real-time and ongoing visibility into their investments without having to mediate with an exchange or third party.”).

³⁰ The courts have interpreted section 11 damages liability for material misstatements in a registration statement as applying only to the securities that the statement actually registers. *See Barnes v. Osofsky*, 373 F.2d 269, 272 (2d Cir. 1967). This poses a problem for registration statements filed in connection with a seasoned offering or direct listing. When such a registration statement contains a material misstatement, it is currently technologically impossible for potential plaintiff who acquired a share in the secondary market after the registration statement's effective date to trace whether the share she acquired was one that was registered by that registration statement since shares that have and that have not been registered by this registration statement are both trading interchangeably in the market. Section 11 liability thus is a key concern with direct listings, which has become a new way to go public following the examples of unicorns Spotify and Slack. *See, e.g.*, Letter from Jeff Mahoney, Gen. Couns., Council of Inst. Invs., to Vanessa A. Countryman, Sec'y, U.S. Sec. & Exch. Comm'n 9–11 (Sept. 8, 2020), https://www.cii.org/files/issues_and_advocacy/correspondence/2020/20200908%20Letter%20to%20SEC%20w%20attachments.pdf [<https://perma.cc/UG73-G6WE>].

possibility: some tier of equities (smaller companies' stocks, for example, which have a lower volume of trading)³¹ could trade solely on their own single, DLT-based market, thereby eliminating the need for central clearing of these stocks. A member of the nonprofit community pointed out that the SEC is already experimenting with placing stock on a blockchain (though he noted that this would be illegal under current regulation). The Boston Security Token Exchange has sought to become a listing exchange for equities as tokenized securities, relying on the Ethereum public blockchain for certain recordkeeping.³²

Various interviewees saw benefits to particular features of a DLT-based trading system. One member of the financial services industry thought DLT could transform clearing and settlement if deployed in a "widgetized," confidential matter (analogizing this to the move toward a cashless society). Recordkeeping is another important potential application of DLT. A member of the financial services industry pointed out the importance of tracking information, noting that a factor contributing to the 2008 financial crisis was flawed recordkeeping in the derivatives market, which caused problems when credit issues arose and participants could not determine their actual positions.³³ Also, the increased clarity of DLT was commented upon as useful for tracking the

³¹ See, e.g., Gilles Zumbach, *How Trading Activity Scales with Company Size in the FTSE 100*, 4 *QUANTITATIVE FIN.* 441, 442 (2004).

³² For more information, see Order Disapproving Proposed Rule Change, as Modified by Amendment No. 1, To Adopt Rules Governing the Trading of Equity Securities on the Exchange Through a Facility of the Exchange Known as the Boston Security Token Exchange LLC, 85 Fed. Reg. 84,403, 84,404 (Dec. 28, 2020); About BTSX, BOS SEC.TOKEN EXCH., <https://bstx.com/about/> [<https://perma.cc/JRL4-MXCJ>] (last visited May 16, 2021); Letter from Benjamin Connault, Economist, Invs. Exch., to Vanessa Countryman, Sec'y, U.S. Sec. & Exch. Comm'n 2 (Mar. 26, 2020), <https://www.sec.gov/comments/sr-box-2019-19/srbox201919-7004560-214855.pdf> [<https://perma.cc/YQT5-R9KQ>].

³³ See THE FIN. CRISIS INQUIRY COMM'N, THE FINANCIAL CRISIS INQUIRY REPORT 228, 298–301 (2011), <https://www.govinfo.gov/content/pkg/GPO-FCIC/pdf/GPO-FCIC.pdf> [<https://perma.cc/RH8P-6Y9P>].

current ownership of shares in real time, alleviating concerns about the tally of proxy votes actually corresponding to the choices of a firm's beneficial shareholders.³⁴

C. Problems Implementing DLT-Based Systems for Securities

The discussion above highlights a theme: we have heard regulators, industry participants, and academics praise the potential of DLT to facilitate transparency and recordkeeping and reduce the need for trusted intermediaries. Yet those same interviewees expressed major concerns about the technological and economic challenges to implementation, as well as the hurdles to changing existing regulation and the resistance of parties vested in current practices.

Scalability is a significant obstacle to widespread use of a DLT-based trading system, particularly for the stocks of the largest 500 or 1000 public companies. Multiple interviewees stressed that such equities markets see a huge volume of transactions, which occur in microseconds. Currently Bitcoin can handle four transactions per second,³⁵ while over one

³⁴ See *Proxy Voting by Blockchain*, MKTS. MEDIA (Apr. 11, 2017), <https://www.marketsmedia.com/proxy-voting-blockchain/> [<https://perma.cc/A7WE-MX86>] (“Broadridge Financial Solutions, Inc. (NYSE:BR), J.P. Morgan, Northern Trust and Banco Santander today announced the successful completion of a pilot which employs a blockchain technology to enhance global proxy vote transparency and analytics.”); Lubin et al., *supra* note 29 (“We can also initiate template-driven smart contract generation of new assets with the listing requirements based on previously captured issuer data, like a smart prospectus. This has the potential to reduce fees as well as mechanical reliance on third parties. This can also enhance shareholder voting and governance in general, as automation of registry data improves certainty of beneficial ownership and to whom an entitlement or right is due without extensive research or reconciliation. A common registry of ownership associated with an ID means the issuer or issuer’s agent will know exactly who has which rights.”); Spencer J. Nord, *Blockchain Plumbing: A Potential Solution for Shareholder Voting?*, 21 U. PA. J. BUS. L. 706, 708–09 (2019).

³⁵ See Press Release, Bitcoin SV, 9,000 Transactions Per Second: Bitcoin SV Hits New Record (Jan. 28, 2021), <https://www.prnewswire.com/news-releases/9-000-transactions-per-second-bitcoin-sv-hits-new->

thousand transactions occur per second on the U.S. stock exchanges.³⁶ Even if this problem were fixed, the system would undoubtedly require significant levels of financing. Moreover, there is the question of how the payments system would be set up. As one member of the financial services industry explained, the system's basic reliance on financing means that if the benefit of DLT is that it allows transactions to occur instantly, enormous amounts of money would also need to be moved instantly. Using digital coins rather than dollars as payment might appear to solve this problem, but the value of currently available coins is highly volatile, and they have a history of being stolen from digital wallets.³⁷ There are also problems with how such a system would deal with error trades, though one interviewee did note that perhaps this problem would be minimal in an auction setting and hence DLT might be more easily applied there.

Beyond these questions of technological and economic feasibility, there is, as noted by multiple interviewees from the regulatory and broker-dealer communities, the matter of legacy firms having a technological "debt." In other words, even if the benefits to society of switching now (assuming everyone did it at once) might outweigh the costs, the private benefits to firms would not. Switching would require them to abandon investments in existing ways of doing things that are continuing to earn substantial returns. Moreover, the

record-301217145.html [https://perma.cc/YQ4L-RZWH] (comparing Bitcoin's capacity to the press release preparer's).

³⁶ Austin Gerig, High-Frequency Trading Synchronizes Prices in Financial Markets 1 n.3 (Jan. 20, 2015) (unpublished manuscript) (citing UTP PLAN, U.S. CONSOLIDATED TAPE DATA, <https://www.utpplan.com/>), <https://www.sec.gov/files/dera-wp-hft-synchronizes.pdf> [https://perma.cc/E3GZ-A3W3]; see also *supra* note 19 (giving data suggesting that well over 500 transactions occur each second on the New York Stock Exchange alone).

³⁷ See Steven Russolillo, *Hackers Swipe More Than \$40 Million of Bitcoin from Cryptocurrency Exchange*, WALL ST. J. (MAY 8, 2019, 2:27 AM) (on file with the Columbia Business Law Review), <https://www.wsj.com/articles/hackers-swipe-more-than-40-million-of-bitcoin-from-cryptocurrency-exchange-11557296830>.

incumbents are unlikely to be forced to adopt a superior technology due to the fear of potential competition: because of the incumbents' first mover advantages, new competing entrants using DLT-based technology are unlikely to erode substantially, at least in the short run, the market share of the incumbents. These interviewees contrast this situation with AI and machine learning, which can be scaled up much more easily—AI and machine learning is increasingly used successfully in the robo-advising context, for instance.³⁸ Moreover, the current system of stock trading is generally perceived as functioning well and at a lower cost per trade than ever before.³⁹ In sum, these interviewees feel that the various incumbent entities that operate the current system of trading and clearing and settlement are unlikely to experience either strong market incentives or significant regulatory pressures to transition soon to a DLT-based system.

³⁸ See, e.g., *AI To Enhance Investment Decision-Making*, FIDELITY (on file with the Columbia Business Law Review), https://institutional.fidelity.com/app/item/RD_9889536/ai-to-enhance-investment-decision-making.html (last visited Nov. 30, 2020) (“When surveying 900 institutions across 25 countries for the Global Institutional Investor Survey, Fidelity found three-quarters of respondents think it’s unlikely the industry will be the same in seven years. Many cited potential disruption by artificial intelligence (AI), but optimism is generally high around the world about its potential incorporation into many high-value investing functions such as evaluating portfolio performance and risk and determining optimal asset allocation strategy. When it comes to this application, evidence from our survey responses suggests that many of these services are expected to be utilized as a tool to augment work, not fully supplant the roles of analysts or institutions’ investment partners.”).

³⁹ On cost per trade, see Brian F. Mannix, *Finding—and Fixing—Flaws in Financial Market Microstructure*, 12 J.L. ECON. & POL’Y 315, 315 (2016) (criticizing high frequency trading but acknowledging that “[i]n the 21st century, automated algorithmic trading by computers has become the dominant method of exchanging securities, commodities, derivatives, and currencies in major markets around the world. Many more trades take place, at dramatically lower costs per trade, than in the days when human traders stood on a trading floor There is little doubt that automated trading has brought some substantial improvements to the efficiency of financial markets”).

Multiple interviewees also raised privacy concerns. For example, as one member of the legal community suggested, there may be a tradeoff between privacy and the transparency and accuracy of an immutable, decentralized record of transactions that DLT may offer. Investors—especially fundamental value traders—usually prefer to hide their trades for strategic reasons, a view echoed by a member of the broker-dealer committee. The current system preserves privacy quite reliably: a customer gives its order to a broker, which has legal duties to keep the order confidential and to refrain from trading for itself or other customers based on its knowledge of the order, and the broker in turn submits the order to an impersonal exchange.⁴⁰ Another member of the broker-dealer community also said that, in a truly DLT-based system, the full transparency of all transactions may not be a good thing. While any such system could provide records of transactions in anonymous form, anyone might be able to observe a sequence of transactions by a single entity, thereby raising this entity's cost of trading and eroding the trading profits that it can extract based on its research. Hacking and cybersecurity also present significant concerns,⁴¹ so that ensuring a secure blockchain could prove costly and difficult.

Some interviewees, including one from the regulatory community, said brokers would, at least in the short term, probably continue to handle investor orders and trading would continue to occur on exchanges and today's other trading venues, but that clearing and settlement could happen on a DLT-based system.⁴² Using DLT for clearing and

⁴⁰ See FOX ET AL., *supra* note 3, at 97.

⁴¹ See Russolillo, *supra* note 37.

⁴² On some potential DLT platforms, see micobo GmbH, *Technical Difference Between Ethereum, Hyperledger Fabric and R3 Corda*, MEDIUM (Mar. 16, 2018), <https://medium.com/@micobo/technical-difference-between-ethereum-hyperledger-fabric-and-r3-corda-5a58d0a6e347#:~:text=Corda%20is%20a%20permissioned%20blockchain,organisations%20participating%20in%20the%20transaction.&text=Corda%20supports%20smart%20contracts.&text=The%20virtual%20machine%20selected%20for,is%20the%20Java%20Virtual%20Machine> [https://perma.cc/GU8H-NG6P] (analyzing the differences among Ethereum, Hyperledger, and Corda).

settlement seems technologically feasible. As one member of the financial services community put it succinctly: If Walmart can put its supply chain on blockchain, JP Morgan can settle trades on blockchain. The problem, the interviewee asserted, lies in the existence (or absence) of an insurgent (challenger) bank with a vested interest in unseating highly-entrenched current systems.

Also, as one member of the regulatory community cautioned, even this modest reform would probably not eliminate completely the trusted intermediary involved—currently The Depository Trust & Clearing Corporation (DTCC).⁴³ Getting rid of DTCC or its equivalent would also eliminate the oversight that such an entity offers, and so the SEC would likely insist that the new platform include a trusted person. Then, by declaring that trusted person to be a broker-dealer, the SEC could continue to exercise oversight.⁴⁴ This interviewee also said he believed that brokers would have little incentive to participate in any such platform because the SEC has cast doubt on brokers' ability to maintain adequate custody and control of assets on a distributed ledger.⁴⁵ This interviewee also believed that the SEC's desire to have a trusted person in charge was wise—even though it would mean continuing the resource costs and rents associated with a trusted party that a trustless DLT system would eliminate. His broader point was that using DLT for clearing and settlement would not make an entity such as the DTCC obsolete anytime soon, a view shared by other interviewees. And, even if DLT could create real efficiencies, the current incumbent may not have much incentive to make the change to DLT or feel much pressure to do so from regulators.

⁴³ For an overview of DTCC's role, see Ferrick, *supra* note 26, at 626–31.

⁴⁴ See 15 U.S.C. § 78o (2019).

⁴⁵ The SEC recently requested comment on the custody issue. See *generally* Custody of Digital Asset Securities by Special Purpose Broker-Dealers, 86 Fed. Reg. 11,627 (Feb. 26, 2021).

D. Summation and Questions Going Forward

In sum, interviewees thus far expressed some appetite for using DLT for stock trading; however, significant concerns over scalability and oversight remain. As one regulator put it, even if DLT helps with audit trails and recordkeeping, a market still needs some mechanism for bringing parties together. Any real change would require everyone to use blockchain, which will not happen unless regulators come up with a some-years-long plan for implementing it. As noted, perhaps a middle ground would still involve brokers placing orders on exchanges, with clearing and settlement occurring exclusively on a blockchain. But again, the brokers and exchanges would all need to be in the blockchain environment for this to truly work.

The foregoing discussion suggests a few questions going forward. What is being done to think through the implications of a truly trustless system? Even as technology is developed to facilitate a DLT-based trading world, what additionally will need to occur in order to increase market and regulatory appetite for that world? What incentives would lead firms to adopt technology, such as DLT, which is extremely costly and difficult to implement on a large scale?

V. MARKET STRUCTURE

How well are today's markets operating? Can DLT improve or address concerns about market structure? One broad theme emerged from our interviews: There is wide disagreement about which interests our markets should promote and which interests current market structures in fact serve. It is thus important to understand these different points of view in order to see what a DLT-based system might offer and how it should be designed. Understanding these issues, even ones that do not appear to touch directly upon DLT and its application to securities markets, also helps us understand what economic and political obstacles may impede adoption of a DLT-based system. This is true even if, from society's point of view, the benefits would appear to exceed the costs.

Some interviewees, spanning the regulatory and investment communities, felt that the markets were overall operating well and fairly. Different interviewees stressed different positives. One member of the regulatory community believes they are working relatively well at least with respect to price discovery. Another said insiders do not have an advantage over ordinary investors, and buy and hold investors have never been better off given low trading costs and instantaneous executions.⁴⁶ Other interviewees, however, expressed concerns about current market structure— and especially the prices that exchanges charge for proprietary data, the fee and rebate policies of the stock exchanges in their dealings with brokers,⁴⁷ and the paradox of trading venues being both too fragmented and insufficiently competitive.

A. Fees for Proprietary Data

Data concerning best available quotes and transactions occurring on each exchange are available to market participants in a consolidated, SEC-mandated feed referred to as the SIP.⁴⁸ There is a slight delay, however, between when a transaction or a change in a quote occurs and, after processing, its appearance on the SIP.⁴⁹ Each exchange charges a fee for access to this data at the same moment it is sent to the SIP.⁵⁰ The data obtained this way is referred to as proprietary data.⁵¹ The customers are liquidity-supplying market makers and other high speed traders as well as sophisticated brokers.⁵² They are all able to put this access to

⁴⁶ See *supra* note 39 and accompanying text.

⁴⁷ See generally Memorandum from Div. of Trading & Mkts., U.S. Sec. & Exch. Comm'n, to Mkt. Structure Advisory Comm., U.S. Sec. & Exch. Comm'n (Oct. 20, 2015), <https://www.sec.gov/spotlight/emsac/memo-maker-taker-fees-on-equities-exchanges.pdf> [<https://perma.cc/7QY8-VMW7>].

⁴⁸ See FOX ET AL., *supra* note 3, at 28, 126.

⁴⁹ See *id.* at 126.

⁵⁰ See *id.*

⁵¹ See *id.*

⁵² See Concept Release on Equity Market Structure, 75 Fed. Reg. 3,594, 3,606–07 (Jan. 21, 2010).

use in ways that permit them to act more quickly than they could if they relied on the SIP—sometimes to the disadvantage of others in the market.⁵³

A market maker provides liquidity by submitting to exchanges quotes in the form of limit orders.⁵⁴ A limit order, until cancelled, commits the submitter to buy or sell a given quantity of shares at a stated price (the buy price being the “bid,” and the sell price being the “offer” or “ask”). For the market maker, being able to act more quickly also means being able to cancel old quotes and submit new ones faster in response to new transactions or changes in quotes of others. This allows the market maker to better protect itself from costly adverse selection, i.e., selling to someone with information that the stock is worth more than the market maker’s offer, or buying from someone with information that it is worth less than the market maker’s bid. With competition among market makers, this reduction in a cost of doing business presumably lowers the effective “price” (half the spread between bid and ask) that market makers “charge” for their liquidity-supplying services. But, despite this drop in price, many informed traders are worse off as a result of the market makers’ access to proprietary data. This is because the traders find the market makers’ quotes moving against them more quickly when they begin trading on a piece of private information that suggests that a security is mispriced.⁵⁵

High speed traders can also use proprietary data to engage in profitable arbitrage that takes advantage of persons who do not change their quotes as quickly in response to new orders

⁵³ See FOX ET AL., *supra* note 3, at 126–27.

⁵⁴ For a brief introduction to these concepts, see *id.* at 20–23.

⁵⁵ *Cf.* Market Data Infrastructure, 86 Fed. Reg. 18,596, 18,599 & n.26, 18,560 & n.28 (Apr. 9, 2021) (to be codified at 17 C.F.R. pts. 240, 242, 249) (noting the disadvantages experienced by traders with slower or less comprehensive access to market data).

or quotes of others.⁵⁶ Brokers can use the information to trade for their clients with less impact on price.

The SIP does not contain information about quotes that are inferior to the best quotes on each market, referred to as “depth of book” information.⁵⁷ This information may contain hints about what the persons who posted the quotes might know. And it is valuable to brokers because often the best quote is only for the purchase or sale of a small number of shares, and so filling a larger order quickly will require transacting against these inferior quotes as well.⁵⁸ Access to this depth of book data is also sold by exchanges and is also referred to as proprietary data.⁵⁹

A number of interviewees felt that prices for proprietary data were too high. One member of the investment industry, who otherwise lauded the markets’ functioning, felt that prices at current levels created persistent inefficiencies. Although proprietary data at current prices appears very profitable for the exchanges, their practices vary, and not all members of the exchange community defend the current arrangements. One member of the broker-dealer community stated that the cost of proprietary data was like a tax on investors. As another member of the exchange community pointed out, relying solely on the SIP for market data is insufficient for brokers to meet their obligation to execute their customers’ orders on the best terms practicable (referred to as the broker’s “best execution” duty),⁶⁰ which essentially forces brokers to pay the very high price for data that most exchanges charge.⁶¹ And at least one member of the exchange

⁵⁶ See, e.g., Stanislav Dolgoplov, *Wholesaling Best Execution: How Entangled Are Off-Exchange Market Makers*, 11 VA. L. & BUS. REV. 149, 189 (2016).

⁵⁷ FOX ET AL., *supra* note 3, at 28.

⁵⁸ For an illustration of this, see *id.* at 27–28.

⁵⁹ *Id.* at 126.

⁶⁰ See FOX ET AL., *supra* note 3, at 265–67 (discussing the best execution duty).

⁶¹ For similar views, see Market Data Infrastructure, 86 Fed. Reg. at 18,560 n.28.

community explicitly expressed a desire for additional regulation around market data pricing—as they and others worried that exchanges had more incentive to serve the interests of high frequency traders (HFTs) and brokers than the interests of longer-term investors—and for better enforcement of existing regulations.

B. Rebates and User Fees

Most exchanges pay a broker a rebate per share for every standing limit order sent by the broker that is executed against (thus rewarding the person making liquidity) and charge a somewhat larger fee per share for every marketable order that executes against a standing limit order (thus charging the person who takes liquidity).⁶² This is the “maker-taker” fee system.⁶³ A few exchanges do the opposite, operating “taker-maker” fee systems.⁶⁴ And one exchange charges the same smaller fee to both the liquidity maker and taker.⁶⁵ Importantly, in all these arrangements the rebates go to, and the fees are charged to, the broker submitting the order, not the customer for whom the order is being submitted.⁶⁶

The maker-taker and taker-maker systems raised concerns among some interviewees about brokers’ conflicts of interest: the broker, rather than seeking best execution of the transaction that its customer wishes to undertake, might send its orders to an exchange with, say, the largest rebates or lowest fees. As one interviewee noted, it is very difficult to see which brokers are receiving rebates for which trades and thus to monitor brokers to see if the rebates and fees are inducing them to violate their duties of best execution. Some

⁶² FOX ET AL., *supra* note 3, 281–82.

⁶³ *Id.*

⁶⁴ *Id.* at 282.

⁶⁵ See *Investors Exchange Fee Schedule*, INVS. EXCH. (Apr. 1, 2021), <https://iextrading.com/trading/fees/> [https://perma.cc/47ZA-33DZ] (advertising this system for at least some trades).

⁶⁶ See, e.g., *id.*

interviewees worried that such violations are occurring. As one member of the broker-dealer community told us, brokers would continue to trade on exchanges that offered them rebates, regardless of client execution, and those exchanges would continue to offer rebates in order to attract business, creating a conflict of interest. While acknowledging the difficulty of quantifying differences in execution quality, this interviewee suggested that a system for more efficiently aligning incentives would require everyone that places an order that executes, whether they are the party making the liquidity or the one taking it, to pay a set per-share fee for using the exchange based on some kind of cost-plus formula. Concern over conflicts of interest in part prompted interest from at least a few interviewees in MEMX, a new exchange that the SEC approved in May 2020⁶⁷ and that is being backed by institutional investors.⁶⁸ MEMX, according to its proponents, is designed to cost less and be more transparent than existing exchanges.⁶⁹

C. Order Protection Rule

Under the SEC's NMS Rule 611 (known as the order protection rule), in most circumstances, a marketable buy or sell order sent to an exchange whose best quote for the stock is inferior to the best quote on some other exchange must be sent on to that other exchange.⁷⁰ When the rule was introduced, it was justified as both assuring retail investors that they would get best execution and helping the competitive position of new entrant exchanges, which, because they were initially small, might not have their quotes

⁶⁷ MEMX LLC, 85 Fed. Reg. 27,451, 27,451 (U.S. Sec. & Exch. Comm'n May 8, 2020).

⁶⁸ See Philip Stafford, *BlackRock Throws Support Behind US Exchange Start-up MEMX*, FIN. TIMES (May 12, 2020) (on file with the Columbia Business Law Review), <https://www.ft.com/content/6aad5b60-5378-476f-9636-4d06017fff9e>.

⁶⁹ See MEMX Home Page, MEMBERS EXCH., <https://memx.com/> [<https://perma.cc/68AV-Y7BU>] (last visited Apr. 4, 2021).

⁷⁰ 17 CFR § 242.611(a) (2020).

executed against—even when those quotes were the best—and hence not attract many quotes in the first place.⁷¹ Multiple institutional investor interviewees criticized the rule, however, for complicating the filling of larger orders. One such interviewee, who did not like the order protection rule because it created risks when sourcing liquidity, suggested that applying the rule differently to institutional and retail order flows could help. This interviewee’s enthusiasm for the institutional-investor-backed MEMX exchange in part reflected the role that this exchange could play in such an approach.

D. Fragmentation

As recently as the early 1990s, trading the stock of any significant, publicly traded company “was still largely confined to a *single venue*, either NASDAQ or the New York Stock Exchange (NYSE).”⁷² Today, any given stock is potentially traded on each of almost seventy-five competing venues: more than a dozen exchanges and almost fifty dark pools.⁷³ This transformation is a product of both the huge “increases in the speed of communication and calculation that have arisen from the information technology revolution” and deliberate choices in the way stock trading is regulated.⁷⁴ Going back as far as the 1970s, Congress and the SEC anticipated that developing technology could, on the one hand, achieve the advantages of competition—lower prices, better customer service, and more innovation—and, on the other hand, because markets would be better connected, decrease the risk that a buyer and seller, each willing to transact for a

⁷¹ See Regulation NMS, 70 Fed. Reg. 37,496, 37,501 (June 29, 2005) (codified as amended in scattered parts of 17 C.F.R.) (giving best execution and competition justifications).

⁷² See FOX ET AL., *supra* note 3, at 13 (emphasis added).

⁷³ *Id.* (citing LAURA TUTTLE, ALTERNATIVE TRADING SYSTEMS: DESCRIPTION OF ATS TRADING IN NATIONAL MARKET SYSTEM STOCKS 5–6 (2013), <https://www.sec.gov/divisions/riskfin/whitepapers/alternative-trading-systems-10-2013.pdf> [<https://perma.cc/88GD-GW4U>]).

⁷⁴ *Id.* at 14.

given price, would not find each other because they were searching for a counterparty in different venues.⁷⁵

A number of interviewees felt that the proliferation of trading venues has gotten out of hand, i.e., that there is too much “fragmentation.” One member of the broker-dealer community, for example, suggested that today’s level of fragmentation did not create more competition but just spread participants across more venues. In his view, this benefited market makers, proprietary traders, and exchanges, at the expense of longer-term investors. Fragmentation may help make the United States a cheap place to operate for the small trader, he suggested, but it raises costs for brokers and for institutional clients trying to move large amounts of stock. Notwithstanding this claim, one interviewee from the market maker community was also unhappy with the current level of fragmentation and stated that having more venues made it more difficult for market makers to use one exchange to undo a transaction on another. It also made the task of market making more random. A member of the broker-dealer community suggested that regulators needed to determine the inflection point at which additional trading venues become a drag on execution quality (this interviewee speculated that four or five venues might be the sweet spot).

Fragmentation raises interesting issues for any application of DLT to stock trading.⁷⁶ To obtain the full measure of DLT’s potential cost savings, all trading of any given stock would occur on one DLT-based venue, which, in addition to replacing all the current trading venues, would automatically do the work of all the various entities currently devoted to clearing and settlement, transferring shares, maintaining custody, and managing firm corporate stock ledgers. Such a transformation within a regulated industry such as securities would be no easy task: all these incumbents would lose the rents they currently enjoy and would likely

⁷⁵ *See id.*

⁷⁶ *See* David C. Donald & Mahdi H. Miraz, *Multilateral Transparency for Securities Markets Through DLT*, 25 *FORDHAM J. CORP. & FIN. L.* 97, 107–09 (2019).

mount stiff political resistance. Moreover, any market structure established by the DLT trading venue would have to mediate the same conflicts of interest among different types of traders that we see in today's market. And, as one interviewee noted, a single DLT-based venue would be a monopoly, meaning it would lack competitive pressure to provide customer service and to innovate and would likely require some kind of rate regulation to avoid monopoly pricing.

E. Special Regulatory Status of the Stock Exchanges

The current regulatory structure governing the securities markets was established back in the 1930s.⁷⁷ At that time, each U.S. stock exchange was a nonprofit with considerable authority over the practices of its broker-dealer members.⁷⁸ The federal securities laws required each exchange to register with the SEC and become subject to its supervision and rules.⁷⁹ But each exchange retained its special status as a "self-regulatory organization" (SRO), allowing it to continue much of its traditional regulatory role, now essentially delegated to it by the SEC, and entitling it to certain protections not available to broker-dealers.⁸⁰ Starting in the 1990s, the stock exchanges all converted to for-profit institutions, but they were allowed to keep their status as SROs.⁸¹ As pointed out by one member of the regulatory community, the relationship between the exchanges and the SEC continues to deteriorate and is characterized by extensive legal battles over the very authority of the SEC. Also, another member of the regulatory community noted that Regulation NMS (Reg NMS) succeeded in promoting competition, but now the different kinds of

⁷⁷ See FOX ET AL., *supra* note 3, at 272.

⁷⁸ See *id.* at 273 (discussing exchange authority); Reena Aggarwal, *Demutualization and Corporate Governance of Stock Exchanges*, J. APPLIED CORP. FIN., Spring 2002, at 105, 105 (discussing the non-profit model).

⁷⁹ FOX ET AL., *supra* note 3, at 273.

⁸⁰ *Id.*

⁸¹ See Aggarwal, *supra* note 78, at 105, 109.

trading venues—exchanges versus non-exchange trading venues such as dark pools and internalizers—are competing on their regulatory burdens,⁸² and differences in such burdens need to be closely examined.

Any DLT-based system would, for both regulatory and speed-of-transactions reasons, probably need a trusted party, and this trusted party would raise anew the same kind of regulatory issues as the exchanges do today. These include whether the system should be a non-profit with broker-dealers as members or a for-profit entity, and whether it should have SRO status.

F. The Technological Arms Race

As noted earlier, various market participants—market makers, other high frequency traders, and sophisticated brokers placing orders for investors—seek to get, and act upon, as quickly as possible data about changes in existing quotes and new transactions.⁸³ In their world, victory goes to the swift. This prompts a technological arms race that the current level of fragmentation fuels by requiring each such entity to have an advanced computer located close to each exchange's matching engine (so called "co-location") and a high-speed communications network linking all these co-located computers.⁸⁴ These computers then use algorithms to decide what quotes to make or cancel and what trades to make, all based on the information each receives from its own exchange and from the other co-located computers in its network.⁸⁵ One member of the financial services industry pointed out that market makers spent hundreds of millions of dollars simply to remain defensive and able to quote⁸⁶—a form

⁸² For a similar view, see Steven McNamara, *The Stock Exchange as Multi-Sided Platform and the Future of the National Market System*, 2018 B.Y.U. L. REV. 969, 989–91.

⁸³ See *supra* Section V.A.

⁸⁴ See FOX ET AL., *supra* note 3, at 96.

⁸⁵ See *id.* at 95–96.

⁸⁶ For an estimate of revenues from market data and co-location, see Eric Budish, Robin S. Lee & John J. Shim, A Theory of Stock Exchange

of competition among HFT market makers that is viewed by at least one member of the exchange community as wasteful. Another interviewee expressed a similar concern for the costs it imposes on fundamental value traders. As a member of the broker-dealer community put it, if a broker updates its technology once a year, it's going to be far behind by the eleventh month. Having a stock trade exclusively on a single DLT-based platform would make much of this costly effort unnecessary.

G. The Quality of the Market for Large Issuer Stocks Versus that for Smaller Issuer Stocks

One member of the exchange community expressed concern that the secondary trading markets function well for large corporations, but not as well or as smoothly for smaller issuers, which have a much lower trading volume and less liquidity.⁸⁷ The prospect that their shares, if publicly traded, would lack high liquidity removes the incentives for many startups and smaller corporations to use a public offering as a way of raising new capital. Consequently, tech giants such as Apple and Google dominate the innovation segment of the market.⁸⁸ Why smaller firms have so much less liquidity is

Competition and Innovation: Will the Market Fix the Market? 36 *tbl.4.2* (July 22, 2020) (unpublished manuscript), <http://www.people.fas.harvard.edu/~robinlee/papers/ExchangeComp.pdf> [<https://perma.cc/BMK2-JEYH>].

⁸⁷ See Zumbach, *supra* note 31, at 442 (linking firm size and trading volume).

⁸⁸ With about 16.7 billion shares outstanding and a market capitalization over \$2.1 trillion, Apple sees an average volume of about 100 million trades. See Apple Inc. Statistics, YAHOO! FIN., <https://finance.yahoo.com/quote/AAPL/key-statistics?p=AAPL> [<https://perma.cc/HAS4-2SGJ>] (last visited May 17, 2021). The corresponding figures for Alphabet (Google's parent) are about 323.6 million, \$1.5 trillion, and 1.4 million. Alphabet Inc. Statistics, YAHOO! FIN., <https://finance.yahoo.com/quote/GOOG/key-statistics?p=GOOG> [<https://perma.cc/5HVZ-G3C7>] (last visited (May 17, 2021).

hotly debated.⁸⁹ The exchange community member referred to above suggested that, under current arrangements, broker-dealers gain much of their profits from trades of these smaller issuers and so tend to resist reform. One member of the broker-dealer community attributed the problem to a lack of information about smaller issuers. He gave an example: the prohibition on advertising through testimonials in the Investment Advisers Act⁹⁰ has disadvantaged innovators, who cannot afford to spend as much as incumbents on advertising and cannot rely on testimonials, which would be the most cost-effective means of advertising.

The prospect of DLT-based trading raises interesting possibilities here. As noted earlier, the scalability issues of DLT-based trading are less relevant for smaller, lower-trading-volume issuers,⁹¹ and so the trading of such issuers' shares is a good starting point for DLT. At the same time, designing the system to ameliorate the market structure issues that may contribute to the problems these issuers have on the exchanges might make public offerings more attractive to them.

H. Debt Markets

Finally, many interviewees expressed concerns about inefficiency and lack of transparency in the debt markets. For example, one member of the financial services industry blamed the lack of such transparency for Lehman's collapse: more transparency would have increased liquidity and given the market more faith that the realizable underlying fundamental value of Lehman's assets was sufficient for it to meet its obligations. Illiquidity also contributes to volatile

⁸⁹ See Kathleen Weiss Hanley, *The Economics of Primary Markets*, in SECURITIES MARKET ISSUES FOR THE 21ST CENTURY, *supra* note 4, at 34, 74–75.

⁹⁰ See 17 C.F.R. § 275.206(4)-1(b) (2020).

⁹¹ See *supra* Section IV.B.

pricing.⁹² This interviewee observed that the large margins enjoyed by broker-dealers due to the lack of transparency reduces any incentive to invest in electronic markets or technology, ultimately hurting consumers. Any move toward electronic markets is also slowed by the lack of homogeneity in bond markets with tens of thousands of individual issues, as a member of the broker-dealer community pointed out. These concerns were echoed by a member of the regulatory community, who worried that Americans tend to turn to debt markets as they get older,⁹³ but very high markups and spreads make getting cash in or out expensive.

I. Summation and Questions Going Forward

In sum, while some agreement emerged that equity markets are generally functioning well, at least with respect to price discovery, concerns were expressed about a number of issues that any development of DLT-based market systems will need to carefully consider. As markets become increasingly fragmented and complex, are the interests that past and present structures were designed to serve still being served? Should they be? To the extent that DLT transforms structural operations in markets, can it alleviate some of the issues identified in this section?

VI. PUBLIC VERSUS PRIVATE MARKETS

Private, rather than public, markets are increasingly providing capital: startups now amass millions, even billions, of dollars in venture capital or private equity funding before,

⁹² See Joshua Mitts, *Short and Distort*, 49 J. LEGAL STUD. 287, 301 (2020).

⁹³ See James Poterba et al., *Lifecycle Asset Allocation Strategies and the Distribution of 401(k) Retirement Wealth 4* (Nat'l Bureau of Econ. Rsch., Working Paper No. 11974, 2006), https://www.nber.org/system/files/working_papers/w11974/w11974.pdf [https://perma.cc/9C4C-ETC5] (noting a weak decline in equity portfolio shares with age).

if ever, considering an IPO.⁹⁴ Indeed, for many that do ultimately go public, they no longer do so for the traditional reason that the higher liquidity of publicly traded shares makes them more valuable and hence that a public offering of shares is an attractive way of raising capital. Instead, they go public for reasons related to the fact that, with the growth of the firm, it has issued stock to many employees.⁹⁵ Or, as unicorns such as Spotify and Slack have done, they go public through a direct listing, which raises no capital but, by allowing trading of their shares on public markets, allows

⁹⁴ See Edward F. Greene et al., *The Need for a Comprehensive Approach to Capital Markets Regulation*, 2021 COLUM. BUS. L. REV. 714. In 2019, for example, over \$1.5 trillion was reported raised under Regulation D alone, which exceeds the \$1.2 trillion was raised through registered offerings in the same time period. See U.S. SEC. & EXCH. COMM'N, REPORT TO CONGRESS ON REGULATION A / REGULATION D PERFORMANCE 3 (2020), <https://www.sec.gov/files/report-congress-regulation-a-d.pdf> [<https://perma.cc/VQ6S-78KU>]; see also generally DAVID BABOOLALL ET AL., MCKINSEY & CO., A YEAR OF DISRUPTION IN THE PRIVATE MARKETS (2021), <https://www.mckinsey.com/~media/mckinsey/industries/private%20equity%20and%20principal%20investors/our%20insights/mckinseys%20private%20markets%20annual%20review/2021/mckinsey-global-private-markets-review-2021-v2.pdf> [<https://perma.cc/5HFJ-C3UL>] (giving an overview of private funding data).

⁹⁵ The very number of employee shareholders, if high enough, triggers federal securities law disclosure obligations, making the disclosures connected with a public offering much less of an additional burden. Even without that trigger, these employees will be pushing for their shares to be publicly traded so that it is easier for them to cash in. In particular, section 12(g) of the Securities Exchange Act of 1934 requires registration by any issuer with more than a threshold number of stockholders of record and with that registration comes the obligation to provide mandated periodic disclosure. See 15 U.S.C. § 78l(g)(1)(A) (2019). This was a major concern which drove both Facebook and Twitter towards IPOs. See, for example, Twitter's request for relief from section 12(g). Letter from Daniel J. Winnike, Partner, Fenwick & W. LLP, to Thomas Kim, Off. of Chief Couns., Div. of Corp. Fin., U.S. Sec. & Exch. Comm'n 6–11 (Aug. 23, 2011), <https://www.sec.gov/divisions/corpfin/cf-noaction/2011/twitter091311-12gh-incoming.pdf> [<https://perma.cc/T6CZ-Q43K>].

their founders and early investors to sell and reduce risk by diversifying their portfolios.⁹⁶

A. The Potential Impact of DLT on the Relative Size of Private Versus Public Markets

How might DLT play a role in this divide? In a sense, there may be a horse race here, with DLT enhancing the attraction of both staying private and going public. On the one hand, DLT could significantly improve private market liquidity by making it cheaper and easier for qualified buyers and sellers—accredited investors—to find each other and have their trades cleared and settled.⁹⁷ It could also make private markets more transparent, a concern touched upon in many discussions. In support of this view, one interviewee involved in private markets noted that blockchain technology—through smart contracts, for example—can speed up any given trade and that smart contracts are already being used to facilitate liquidity in private markets.⁹⁸ The underlying technology of DLT, which mediates complex transactions efficiently, could also be used to restrict transfers of private securities only to those allowed by law or by corporate provisions to acquire them. The entrepreneurs of some

⁹⁶ Greg Rodgers, Marc Jaffe & Benjamin Cohen, *Evolving Perspectives on Direct Listings After Spotify and Slack*, HARV. L. SCH. F. ON CORP. GOVERNANCE (Dec. 17, 2019) <https://corpgov.law.harvard.edu/2019/12/17/evolving-perspectives-on-direct-listings-after-spotify-and-slack/#:~:text=In%20June%202019%2C%20Slack%20completed,founders%20and%20their%20respective%20companies> [https://perma.cc/KCM7-7RAY].

⁹⁷ See *supra* Section IV.A.

⁹⁸ See, e.g., Lubin et al., *supra* note 29 (“Smart contracts are automated actions that can be coded and executed once a set of conditions is met. They have the ability to remove some of the more manual components of the financial industry—such as the process of distributing dividends—by placing the execution of the action on the blockchain via automated code, instead of in the hands of human operators. . . . [T]he complex process of paying out dividends, splits, issue of rights, warrants, pay-ups, and so on, now can be automated, resulting in more confidence from investors and a much lower margin of error.”).

companies would welcome a setting in which their shares gained greater liquidity, but where they could still exercise some control over the nature of their shareholder base.

On the other hand, as we have noted above in the discussion of market structure,⁹⁹ there are many ways that a DLT-based system might help the public securities markets. DLT might persuade companies to go public earlier in their lives given that, for scalability reasons, smaller firms are the better initial candidates for DLT-based trading.¹⁰⁰ Also, as some interviewees noted, DLT could make being a public company more attractive generally by reducing the mechanical costs of distributing dividends and announcements to, and soliciting and counting the votes of, the much larger number of shareholders that accompanies being a public company.

DLT could also help the public markets by improving the disclosure required of public companies. Broadly, the backbone of the regulation of publicly traded securities has been the mandatory issuer disclosure rules.¹⁰¹ Although they are often justified as protecting investors, most scholars believe disclosure's more important function is the promotion of accurate share prices.¹⁰² This in turn enhances the efficiency of the larger economy in a number of ways, including by improving corporate governance. Also, by reducing insider trading, disclosure enhances liquidity in the markets.¹⁰³

The prime consumers of disclosure have been professional securities analysts who use it to guide the investment funds that employ them.¹⁰⁴ Traditionally, this disclosure has come

⁹⁹ *Supra* Part V.

¹⁰⁰ *See supra* Section V.G.

¹⁰¹ *See* Greene et al., *supra* note 94, at 717.

¹⁰² *See* Merritt B. Fox et al., *Law, Share Price Accuracy, and Economic Performance: The New Evidence*, 102 MICH. L. REV. 331, 368 (2003).

¹⁰³ On some of these relationships, see generally Merritt B. Fox, Lawrence R. Gosten & Gabriel V. Rauterberg, *Informed Trading and Its Regulation*, 43 J. CORP. L. 817 (2018).

¹⁰⁴ *See* Fox et al., *supra* note 102, at 348 n.45.

in the form of answers to SEC form questions.¹⁰⁵ The issuers publish these answers periodically in SEC filings.¹⁰⁶ New technology related to DLT may allow analysts direct and continuous access to raw data from within issuers.¹⁰⁷ This could both enhance share price accuracy and reduce the trading advantages of corporate insiders. The question, though, is whether these gains outweigh the costs. In particular, how could issuers protect proprietary information from their competitors? And would making this data available to highly sophisticated analysts be unfair to other investors? To the extent that these factors are indeed problems, could new methods of disclosure be designed to minimize them?

One interviewee from the issuer community suggested that, if DLT made private markets more attractive by making shares more liquid, private and public markets might be more complements than competitors. The idea is that greater liquidity in the private market would make the prices there more accurately reflect the true value of a firm's shares. This in turn would make a subsequent public offering simpler and less risky. Indeed, if the firm and the public market both viewed the price discovery capabilities of the private market as good enough, the firm might be able to do the public offering directly into the market without the intermediation of an investment bank. This is because an important function of the bank in such an offering is to reduce the risk associated with choosing the initial price—one that is neither too low and hence leaves money on the table, nor too high so that many of the offered shares go unsold—and doing so in a way that puts the bank's money where its mouth is.¹⁰⁸

¹⁰⁵ See, e.g., generally The Coca-Cola Co., Annual Report (Form 10-K) (Feb. 25, 2021) (providing such disclosures).

¹⁰⁶ See, e.g., generally *id.*

¹⁰⁷ Cf. Jesse Marks, *Distributed Ledger Technologies and Corruption the Killer App*, 20 COLUM. SCI. & TECH. L. REV. 42, 78–80 (2018) (describing some of the private sector monitoring uses of DLT).

¹⁰⁸ In a firm commitment underwriting, the investment bank buys all the shares being offered from the issuer at the offering price minus a discount. Thus, the bank takes the risk if the price is too high and the

B. Issues Related to the Public/Private Market Divide

To fully understand how using DLT in private or public markets might affect the divide between the two requires a discussion of how the divide is currently viewed. Because private firms are not subject to mandatory disclosure requirements, some interviewees with regulatory experience expressed the fear that, with larger and larger firms staying private, we lose the corporate governance benefits of public markets. One member of the investment industry argued, however, that private markets were actually better at creating value and strengthening corporate governance. The argument is that index funds typically pay little attention to corporate governance but hold an increasing percentage of public company shares, so companies are generally being subject to less shareholder monitoring. In contrast, private equity firms play a much greater role in running a company and improving corporate governance, largely because they are not burdened by liquidity concerns and friction (no material nonpublic information concerns, lock-up periods, etc.).¹⁰⁹ As a result, there are fewer principal-agent issues, which has incentivized many companies to remain private—rather than going public with absentee shareholders. Moreover, this interviewee believed that competition between private equity firms and other investors made valuations more robust in private markets.

But other interviewees disagreed, saying some private valuations are illogical and citing WeWork as an example.¹¹⁰

offering does not sell out. Marcel Kahan, *Securities Laws and the Social Costs of “Inaccurate” Stock Price*, 41 DUKE L.J. 977, 1011–12 (1992).

¹⁰⁹ For a summary of similar distinctions drawn in the literature by some, see, for example, Michal Barzuza, Quinn Curtis & David H. Webber, *Shareholder Value(s): Inded Fund ESG Activism and the New Millennial Corporate Governance*, 93 S. CAL. L. REV. 1243, 1258–65 (2020).

¹¹⁰ See Liz Hoffman & Maureen Farrell, *WeWork’s Valuation Falls to \$8 Billion Under SoftBank Rescue Offer*, WALL ST. J. (on file with the Columbia Business Law Review), <https://www.wsj.com/articles/softbank-offers-to-put-6-5b-into-wework-including-5b-loan-11571687872> (last updated Oct. 21, 2019).

A member of the investment community blamed venture capital for contributing to price inaccuracy, noting that venture funds were trying to undercut competitors at an unsustainable level. If relatively inefficient private markets are growing more than relatively efficient public markets, that could lead to problems for society, the interviewees said, with inferior projects receiving scarce capital that could have gone to more promising ones.

Whether private markets or public markets produce higher returns was another point of disagreement. For example, one member of the regulatory community thought private equity generally earned higher returns, even after adjustment for higher risk, while another member of the regulatory community did not think so. This disagreement is important because, as discussed below, one of the main arguments for giving ordinary investors more access to private markets is that they are currently being denied these higher returns.¹¹¹

Interviewees also disagreed about why the private markets were growing. Two members of the investment and exchange communities believed that costs were a significant deterrent to going public. A member of the regulatory community said that, while individual disclosure requirements were justifiable, in total they could be so burdensome that they also deterred companies from going public. Similarly, a former regulator said that “overregulation” in public markets, and the ubiquity of litigation,¹¹² slowed progress and innovation.

Yet another regulator expressed the opposite view: it is not the SEC’s job to encourage additional IPOs, and, in any event, choosing to go public is an existential decision for a firm, and the amount of regulation or legal paperwork is not a true obstacle for a firm that wants to make this transformation. A member of the investment industry agreed that disclosure and

¹¹¹ See *infra* Part VII.

¹¹² Securities class action filings fell in 2020 but generally have been increasing over time. See CORNERSTONE RSCH., SECURITIES CLASS ACTION FILINGS: 2020 YEAR IN REVIEW 5 fig.4 (2020), <https://www.cornerstone.com/Publications/Reports/Securities-Class-Action-Filings-2020-Year-in-Review> [<https://perma.cc/C5YK-VFMF>].

compliance costs were not a meaningful burden and said that, in fact, heads of corporations hid behind this complaint when what they really did not like was the scrutiny that they received as a result of the rules. Interestingly, one member of the issuer community suggested that, although his firm viewed required disclosure as simply a cost worth incurring when it went public, preparing periodic disclosures actually helped the firm manage its affairs. Coming at the issue from the other side, one interviewee from the legal community felt that the SEC, in an effort to promote startups and the like, went too far in allowing firms to raise capital without engaging in a registered public offering and its extensive disclosure requirements.

Interviewees also raised questions about the kinds of information that public firms are required to disclose. At least one member of the legal community remarked on the importance of forward-looking disclosures, which are not required,¹¹³ although they also acknowledged their drawbacks—e.g., their particular potential to mislead. Another interviewee, a member of the regulatory community, thought that some disclosure requirements might be irrelevant to investment decisions and further cluttered already dense disclosure documents.

A member of the regulatory community suggested that the growth of the private markets helps to hold the SEC accountable. The SEC is concerned that some firms are losing out on the improved liquidity of the public markets because they view the accompanying regulation as too burdensome to be worthwhile.¹¹⁴ This puts pressure on the SEC and Congress to redesign certain regulations like “random” rules

¹¹³ The Exchange Act deals with forward-looking statements in section 21E. 15 U.S.C. § 78u-5 (2019). Firms do need to make disclosures about certain trends “known to management.” 17 C.F.R. § 229.303 (2020).

¹¹⁴ See, e.g., Scott Bauguess, Rachita Gullapalli & Vladimir Ivanov, *Capital Raising in the U.S.: An Analysis of the Market for Unregistered Securities Offerings, 2009-2017* 5 (2018), https://www.sec.gov/files/DERA%20white%20paper_Regulation%20D_082018.pdf [<https://perma.cc/7XZH-BAA8>].

about CEO-to-median-worker pay ratios and conflict minerals that can discourage companies from going public.¹¹⁵

Another member of the financial services industry suggested that DLT could allow regulators to “look under the hood” of the way private markets operate, where a variety of new practices are a source of concern to many commentators. Information about those markets has traditionally been hard to come by because of the very fact that they are private.¹¹⁶ For example, with DLT it could become much easier for regulators to determine whether private-market investors actually qualify as accredited investors. One member of the regulatory community, however, played down concern with what is going on in the private markets, stressing that many of the new approaches to capital raising and trading that disturb some commentators are still largely funneled through broker-dealers, who remain subject to SEC scrutiny.¹¹⁷

C. Summary and Questions Going Forward

In sum, there is significant disagreement about whether the rise of private markets is desirable. Some applaud private markets for their value-creation potential, while many others are concerned about their lack of transparency and requirements for issuer disclosure and would alter regulations to encourage more companies to go public. A few questions in particular stand out going forward. Can DLT narrow differences in the amount of information available in private and public markets? Can DLT alleviate concerns around private market growth and access to investors, and can it streamline disclosure obligations for companies considering going public?

¹¹⁵ See Donald C. Langevoort, *The Regulation of Primary Markets*, in SECURITIES MARKET ISSUES FOR THE 21ST CENTURY, *supra* note 4, at 101, 134–37.

¹¹⁶ *Id.* at 125–26.

¹¹⁷ On broker regulation in this context, see *id.* at 127.

VII. THE ORDINARY INVESTOR

Closely tied to the above discussion is the role of ordinary “unsophisticated” investors, who have long had a fraught history with equity investing. As multiple interviewees have observed, DLT could either ameliorate or significantly exacerbate these problems. What happens depends largely on whether DLT can expand ordinary investors’ access to information that is meaningful to them in their choice of investments.

All else equal, access to a broad range of equities is good for an investor because it improves their range of investment and savings options. All is not equal, however, because most ordinary investors lack much relevant information and the time and skill to analyze the information they do have—a concern raised, for example, by one member of the broker-dealer community. A former regulator went further, questioning the wisdom of letting retail investors participate in non-index-fund markets given their ignorance of the complexity of modern markets,¹¹⁸ especially in light of technological changes such as the rise of HFTs and algorithmic trading.

Ordinary investors have relatively open access to stocks trading in the public markets.¹¹⁹ These markets, and the issuers of the stocks that trade in them, are heavily regulated, in part to protect ordinary investors from fraud and risks they otherwise might not anticipate.¹²⁰ The private markets are much more lightly regulated, but access to them is restricted, and they exclude many ordinary investors.¹²¹ Debate continues over whether this structure gets things right. Does it, for example, unnecessarily exclude ordinary investors from

¹¹⁸ See Bruce Ian Carlin & Gustavo Manso, *Obfuscation, Learning, and the Evolution of Investor Sophistication*, 24 REV. FIN. STUD. 754, 754–55, 757–58 (2011).

¹¹⁹ Cf. Hanley, *supra* note 89, at 38.

¹²⁰ See *id.* at 49.

¹²¹ See *id.* at 88.

the most lucrative investment opportunities?¹²² One former regulator worried that it does and therefore disserves the American public. Or are these superior opportunities a myth? Would investors benefit from wider access to the private markets or simply be exposed to more fraud and unanticipated risk? Both a regulator and a member of the investment community thought that giving ordinary investors more access to private markets might create an adverse selection problem, allowing venture and private capital firms to pick off the better offerings and leave retail investors with the rest.¹²³ That regulator and another one expressed serious reservations about brokers who connect investors with private market offerings, noting that they were the brokers subject to the most complaints. The recent expansion of private markets—where some “unicorn” startups have rewarded their venture capitalist and private-equity firm investors astonishing returns¹²⁴—makes answering these questions increasingly urgent.

¹²² Even with the availability of regulatory relief allowing a broad marketing of a company’s securities without needing to file a disclosure-oriented registration statement, private issuers seem to have limited appetites for retail investment. The JOBS Act introduced Rule 506(c) in 2013, allowing private issuers to engage in general solicitation without any disclosure as long as the actual purchasers of the offered securities are “accredited,” a category based on income and wealth that, while cutting out a substantial majority of U.S. households, does not cut out a very high percentage of what would be most of the market, i.e., households that actually directly own public company stock. *See* Jumpstart Our Business Startups Act (JOBS Act), Pub. L. No. 112-106, § 201(a)(1), 126 Stat. 306, 313–14 (2012) (requiring a change in the rule); 17 C.F.R. § 230.501(a)(5)–(6) (2020) (giving the lenient “accredited investor” definition for natural persons). Eight years later, 506(c) offerings remain a small fraction (four percent) of all Regulation D offerings. SCOTT BAUGUESS, RACHITA GULLAPALLI & VLADIMIR IVANOV, CAPITAL RAISING IN THE U.S.: AN ANALYSIS OF THE MARKET FOR UNREGISTERED SECURITY OFFERINGS, 2009–2017, at 2 (2018), https://www.sec.gov/files/DERA%20white%20paper_Regulation%20D_082018.pdf [<https://perma.cc/B2KL-CYED>].

¹²³ For similar reasoning, see Greene et al., *supra* note 94, at 717.

¹²⁴ *See, e.g.*, Heather Somerville, *Tech IPO Bonanza Yields Riches for Venture-Capital Firms*, WALL ST. J. (Dec. 11, 2020, 5:09 PM),

A few interviewees—ranging from investment industry individuals to legal professionals and regulators—thought retail investors might safely participate in private markets by investing in publicly traded funds that in turn invest in the private market.¹²⁵ Retail investors would get access to private markets but delegate the choice of assets to better informed fund managers. This investment vehicle could be structured as either an open-end or closed-end mutual fund.¹²⁶ At least one member of the investment community was skeptical of the open-end option, which would allow the investor to redeem her investment at any time for what the fund deemed her share of the fund's total value, posing valuation problems for both the mutual fund in terms of its portfolio structure as well as for the investor in terms of the fair value of her redemption.¹²⁷ This interviewee believed that the illiquid nature of investments in private companies created too much risk for the ordinary investor with a short-term horizon. Determining

<https://www.wsj.com/articles/tech-ipo-bonanza-yields-riches-for-venture-capital-firms-11607714745> [<https://perma.cc/EQ8S-4DWZ>].

¹²⁵ See John Finley, Expanding Retail Access to Private Markets 10–11 (Nov. 2019), <https://www.sec.gov/spotlight/sbcfac/expanding-retail-access-to-private-markets-finley.pdf> [<https://perma.cc/2TPK-PARR>].

¹²⁶ Mutual fund investment in private equity has been rising. Between 2014 and 2016, twenty-five percent of VC-backed IPOs enjoyed some mutual fund financing, compared to ten percent in the 1990s. See Sungjoong Kwon, Michelle Lowry & Yiming Qian, *Mutual Fund Investments in Private Firms*, 136 J. FIN. ECON. 407, 409 (2020). Between 2011 and 2016, mutual funds provided an average of thirty-eight percent (median of thirty-two percent) of venture capital in the rounds in which they participated. *Id.* at 408.

¹²⁷ The illiquidity of private equity causes valuation problems when such redemptions occur. The mutual fund may find it difficult to value its private equity assets in order to comply with fifteen-percent the holding limits in illiquid assets set by Rule 22e-4, 17 C.F.R. § 270.22e-4(b)(1)(4), while the redeeming investor may decide (perhaps with the benefit of hindsight) that the redemption price is inaccurate and seek action against the mutual fund. Illiquid private equity assets are valued infrequently and often inconsistently, which make such valuation problems inevitable. See Vikas Agarwal et al., Private Company Valuations by Mutual Funds 3–5 (Feb. 20, 2021) (unpublished manuscript) (on file with the Columbia Business Law Review), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3066449.

the fair value of the investor's share would be a problem, too. Probably because of these concerns, mutual funds, despite investing in private equity more than before, in practice stay far below the fifteen percent regulatory limit set by Rule 22e-4.¹²⁸

The alternative, which avoids these problems, is a closed-end fund, where the investor, unlike with the open-end fund, cannot redeem the share with the issue and can cash out only by selling her share of the fund in the secondary trading market. This arrangement, though, creates its own risks because the pricing of the closed-end shares in the secondary market is likely to be based on far less information concerning the underlying operating private firm investments than is the case with the pricing of shares of a publicly traded operating firm. The investor would thus need to rely on what she can ascertain about the skills and integrity of the closed-end fund's managers, and would have no power, based on results, to discipline the managers by withdrawing from the fund as she could do in the case of an open-end fund. One question for the closed-end approach would be whether a DLT-based system could somehow make more information available to the market about a fund's underlying private operating firm investments so that secondary market pricing would be more reliable.

Expanding the definition of an accredited investor is another potential way to open private markets to more investors. Some interviewees suggested redefining the term to include persons who establish a certain level of investment sophistication but do not meet the current income or net worth standards.¹²⁹ However, one former regulator proposed going

¹²⁸ 17 C.F.R. § 270.22e-4(b)(1)(4). The median mutual fund invests only 0.71% of assets in private equity. See Katie Rushkewicz Reichart, *Unicorn Hunting: Large-Cap Funds That Dabble in Private Companies*, MORNINGSTAR (June 3, 2018) (on file with the Columbia Business Law Review), <https://www.morningstar.com/articles/867995/unicorn-hunting-large-cap-funds-that-dabble-in-private-companies>.

¹²⁹ See, e.g., Press Release, U.S. Sec. & Exch. Comm'n, SEC Modernizes the Accredited Investor Definition (Aug. 26, 2020),

further and opening private markets to any investor who used a broker, under the theory that the broker would understand the risks involved and would be bound by Regulation Best Interest to communicate this to the investor.¹³⁰

This discussion ties into a few broader debates about the economy. Market index funds and robo-advisers may, at affordable cost, increase the range of equities in which the savings of ordinary investors can be intelligently invested and provide vehicles for diversifying risk, thus justifying retail investor money directly or indirectly going to a broader range of companies than are currently public.¹³¹ Yet, whether these new features of the market are really helping ordinary investors is an open question. In particular, even if they appear to work under normal circumstances, are they prone to failure in extreme circumstances, thereby introducing systemic risk into the economy and imposing losses at the worst time on those least able to afford them? One member of the broker-dealer community in particular worried that exchange-traded funds (ETFs) would expose retail investors to volatility in times of stress, as they would all move together and investors would seek to exit simultaneously.

In sum, little agreement exists as to the ideal amount of access that retail investors should safely have to equities markets—private or public. While it is conceivable that their lack of access to private markets systematically excludes them from lucrative investments, this is far from clear. Many regulators and market participants questioned the feasibility of providing ordinary investors with access to private markets

<https://www.sec.gov/news/press-release/2020-191> [<https://perma.cc/87NQ-K3FJ>] (using professional certification as a proxy for sophistication).

The SEC has noted that only thirteen percent of U.S. households meet the criteria to be accredited investors. *See* Amending the “Accredited Investor” Definition, 85 Fed. Reg. 2,574, 2,600 (proposed Jan. 15, 2020) (codified at 17 C.F.R. pts. 230, 240).

According to a DERA white paper, only nine percent of Regulation D offerings between 2009 and 2017 included non-accredited investors. BAUGESS ET AL., *supra* note 122, at 34.

¹³⁰ *See* 17 C.F.R. § 240.15l-1(a).

¹³¹ On robo-advising, see *infra* Section VIII.B.

while protecting them from fraud. More broadly, their very ability to understand the complexity of modern markets was raised as a concern.

VIII. INTERMEDIARIES

One broad theme emerges on the topic of intermediaries: currently we rely on *human* intermediaries as the front-line against wrongdoing in the market. As one regulator argued, we should not give up the oversight of the markets that comes through the SEC's regulation of broker-dealers unless we are certain something better is taking its place.

A. The Shrinking Role of Brokers for Ordinary Investors

Most significantly, DLT and AI could accelerate the decrease in the role of retail brokers as a main source of an individual's investment advice.¹³² Currently, all transactions in markets must be done through a broker because the broker, which is supposed to know its customer, provides a backstop to assure that a trade closes should the customer not follow through.¹³³ As discussed earlier, DLT presents the possibility, for example, of a clearing and settlement mechanism that does not rely on a customer's broker to assure the customer's performance.¹³⁴ In that case, the fear that a trader will not perform would no longer be a reason to prevent traders from direct access to exchanges. Similarly, AI-based programs could guide investors as to what to invest in and how to execute their trades—functions also traditionally performed by brokers.¹³⁵

¹³² On the decline of retail brokers, see Regulation Best Interest: The Broker-Dealer Standard of Conduct, 84 Fed. Reg. 33,318, 33,411–13 (July 12, 2019) (codified at 17 C.F.R. pt. 240).

¹³³ See FOX ET AL., *supra* note 3, at 20.

¹³⁴ See, e.g., Lubin et al., *supra* note 29.

¹³⁵ See *infra* Section VIII.B. It should be noted, however, that one former regulator thought that the greatest threat posed by DLT would be more to transfer agents, such as DTCC, than to brokers.

Further, it is possible that DLT, combined with AI-based programs, could completely remove the need for not only retail brokers, but also ETFs and mutual funds. The combination could make transacting frequently, in even slivers of investment, nearly costless. And AI-based robo-investing could guide what purchases and sales should be made and how to execute them at the best prices.

B. Redefinition of Duties

As intermediaries increasingly rely on computers to give investment advice to, and make investment decisions for, investors, questions abound as to their duties to customers.¹³⁶ In 2017, the SEC issued guidance stating that, if structured properly, a digital adviser could be a fiduciary under the Adviser's Act without the need to create new rules.¹³⁷ The scope of such guidance still needs to be fleshed out, and markets and regulators are still learning, as one member of the broker-dealer community informed us. More existentially, that interviewee argued that a computer can know its client quite well given its ability to sort and process huge amounts of data.

However, the importance of human intermediaries should not be understated—a theme that emerged out of multiple interviews. One regulator was skeptical that the SEC would ever tolerate no role for human intermediaries. That same interviewee emphasized that, for example, even with AI-based investing, mechanisms for regulatory oversight were still robust because the humans that created the computer programs were still subject to such oversight. Another former regulator acknowledged that it was reasonable that the SEC

¹³⁶ See, e.g., Tom Baker & Benedict Dellaert, *Regulating Robo Advice Across the Financial Services Industry*, 103 IOWA L. REV. 713, 716–19 (2018); Jake G. Rifkin, Comment, *Robo-Advisers Jumping on the Bandwagon: Yet Another Cry for a Uniform Standard*, 97 N.C. L. REV. 673, 674–675 (2019).

¹³⁷ See Rifkin, *supra* note 136, at 675 (citing DIV. OF INV. MGMT., U.S. SEC. & EXCH. COMM'N, ROBO-ADVISERS 1–2 (2017), <https://www.sec.gov/investment/im-guidance-2017-02.pdf> [<https://perma.cc/RU3S-N5CM>]).

might want to retain intermediaries as the main points of regulation.

These debates occur against a broader backdrop of uncertainty around a broker's duty. For example, multiple interviewees thought the concept of best execution¹³⁸ needs clearer guidance. One member of the exchange community specifically thought that best execution was too vague a concept, hampering FINRA's enforcement, and expressed the view that Regulation Best Interest should go further. In this context, one question is whether DLT could provide needed transparency and clarity as to when a broker was, and was not, achieving best execution.

On a separate front, one member of the legal community expressed concerns about the growth of intermediaries in the form of private equity funds, which raise their funds pursuant to exemptions from the public offering disclosure regime and have sufficiently few investors to avoid most other regulations.¹³⁹ These intermediaries receive funds from institutions or wealthy individuals and then invest that money in debt or equity securities of private companies. He asserted that the total volume of the investments of such funds exceed the total of corporate bank lending.

C. Conclusion

In sum, while interviewees acknowledged the potential of DLT to obviate the need for intermediaries, significant questions remain as to whether doing so is wise or whether regulators would be comfortable with such a world, given the traditional focus on intermediaries as the front-line target for regulators in policing wrongdoing. Thus a number of questions remain: is a system entirely without intermediaries possible? Is it desirable? What concerns would need to be addressed before transitioning to such a system?

¹³⁸ On this duty, see FOX ET AL., *supra* note 3, at 265–67.

¹³⁹ See Langevoort, *supra* note 115, at 134–36.

IX. WRONGDOING

As alluded to in previous sections, traditional methods of discipline in the securities markets focused on disclosure and *human* intermediaries. For example, our current regulatory structure relies heavily on brokers to be the front-line soldiers in the battle against insider and manipulative trading by their customers.¹⁴⁰ How might the regulatory system need to change if brokers drop out of the equation? Could DLT, with its recordkeeping capabilities, offer the means for effective oversight? Could it also help in providing authorities data needed to reduce systemic risk?

The laws around insider trading and market manipulation are already rife with uncertainties. Courts lack clear legislative mandates and are instead simply guided by a small number of very generally worded anti-fraud provisions.¹⁴¹ As a result, the courts have been forced to develop in common-law fashion ways of distinguishing trading-profit-motivated, but socially useful, transactions from practices that simply move money to those who are most artful in what they say or how they trade.¹⁴² Technological advancements expand the menu of possible transactions that need to be distinguished in these ways. For example, HFTs, who depend on ultra-fast communication with diverse trading venues and employ algorithmic quoting and trading decisionmaking, appear to have enhanced liquidity in the markets.¹⁴³ They are also capable of a variety of socially negative trading strategies, however.¹⁴⁴

Innovation in markets is only accelerating. Not many years ago, the SEC struggled to craft responsive rules, Reg NMS, in

¹⁴⁰ *Cf., e.g.*, Merritt B. Fox, Lawrence R. Glosten & Gabriel V. Rauterberg, 35 *YALE J. ON REGUL.* 67, 77 (2018) (noting that brokers are the most common defendants in manipulation cases).

¹⁴¹ *See, e.g.*, 17 C.F.R. § 240.10b-5 (2020) (broadly prohibiting fraud); FOX ET AL., *supra* note 3, at 162–99 (discussing informed trading).

¹⁴² *See* FOX ET AL., *supra* note 3, at 174–75.

¹⁴³ *See id.* at 96, 104.

¹⁴⁴ *Id.* at 124.

anticipation of the advent of HFTs, and yet there are already complaints, as noted above, that our current market-structure rules are obsolete.¹⁴⁵ The line has grown increasingly blurry between socially beneficial transactions that tend to make prices more accurate and markets more liquid, and transactions that should fall under our prohibitions against insider trading or manipulation.

One member of the regulatory community warned of the ensuing dangers: if regulators themselves are unsure of the line, how can market participants calibrate their behavior accordingly? A member of the investment community expressed skepticism of regulators' ability to stay on top of technological innovation, especially as so many laws around wrongdoing depend on identifying intent, an increasingly murky concept given the rise of AI. This is exacerbated, that interviewee pointed out, by the disparities in defining or reconciling wrongdoing across jurisdictions.¹⁴⁶

Against this changing background in terms of the possibilities for wrongdoing, a few questions arise with respect to DLT, both positive and negative. If the system moves toward DLT-based trading, how can it be designed to facilitate enforcement through, for example, recordkeeping and audit trails that associate particular trades with particular traders? Would using DLT to its full potential interfere with enforcement by removing human intermediaries that have traditionally provided regulatory hooks for enforcement agencies? And will some of the efficiency gains offered by a DLT-based trading system need to be foregone in order to keep some enforcement-enhancing human involvement?

¹⁴⁵ See *supra* Part V.

¹⁴⁶ See, e.g., 3 THOMAS LEE HAZEN, TREATISE ON THE LAW OF SECURITIES REGULATION § 12:52, Westlaw (database updated Dec. 2020) (discussing variations in the scienter standard under Rule 10b-5).

X. DIGITAL COINS

One already-significant application of DLT with securities law implications is the digital coin. Bad actors promoted an initial wave of offerings not registered under the Securities Act of 1933 that turned out to be rampant frauds designed to take advantage of the speculative fever surrounding Bitcoin.¹⁴⁷ Uncertainty around the status of cryptocurrency under the securities laws¹⁴⁸ probably reduced the effectiveness of these laws in preventing such offerings. According to one former regulator, this initial wave of fraud has generated great regulatory suspicion of digital coins in general. Another former regulator expressed the concern that this suspicion could choke, or drive abroad, possibly socially-beneficial digital-coin-based innovation. In this regulator's mind, too little attention has been paid to the potentially positive impact of DLT.

Securities regulation as currently interpreted by the SEC has not fully adapted to the fact that digital coins are fundamentally different from equities. On the one hand, what is initially offered is very much like an equity security: the offeror is issuing the item in order to raise money for a project based on its efforts and, if the efforts are successful, the item will be worth more in the future than its offering price.¹⁴⁹ Thus, the initial offering itself needs to be regulated very much like an offering of stock. This way fraud can be prevented and investors can receive enough information to sort the more promising offerings from the less promising ones. On the other hand, if the coin is a success, its ultimate function is very different from that of an equity security, and the regulation of its trading, if any, should probably be outside the scope of the securities regulation regime.¹⁵⁰ Multiple

¹⁴⁷ See Shaanan Cohny et al., *Coin-Operated Capitalism*, 119 COLUM. L. REV. 591, 596 & n.18 (2019).

¹⁴⁸ See *id.* at 608.

¹⁴⁹ See *id.* at 600.

¹⁵⁰ See, e.g., *Framework for "Investment Contract" Analysis of Digital Assets*, U.S. SEC. & EXCH. COMM'N, <https://www.sec.gov/corpfin/framework->

members of the regulatory community noted this particular regulatory problem. As another put it, the SEC decided digital coins were securities because it wanted to properly regulate their public offerings, but it has not fully thought through the other implications of declaring them securities.

To this point, one interviewee from the regulatory community explained that, while many in that community think that the securities laws are flexible enough to accommodate coins, this interviewee disagreed. The interviewee suggested instead a regulatory safe harbor, which would provide time for an innovator to build the token network until the token no longer ran afoul of securities laws. Another interviewee suggested that a whole new regulatory agency was needed that would not have the inherited traditional securities mindset that pervades the SEC.

XI. REGULATORY LEARNING

A major theme arising from our interviews with regulators and industry participants alike is that regulatory fragmentation and regulators' slow reactions are stifling potential innovation, digital coins being just one case in point. Most interviewees, when asked, saw potentially significant applications of DLT technology, but noted that unclear regulations and uncertain enforcement can scare innovators and dissuade market participants from investing in socially beneficial technology. As multiple interviewees said, until regulators foster blockchain-based systems by pushing incumbents to cooperate in adopting them and by providing regulatory relief where, applied to DLT, existing regulations serve no purpose, players in the financial markets will never make the investments necessary to take full advantage of blockchain technology. Regulators' attitude toward innovation needs to fundamentally change, these

investment-contract-analysis-digital-assets [<https://perma.cc/Y76Y-6M3M>] (last modified Apr. 3, 2019) (distinguishing for regulatory purposes coin offerings involving classic capital-raising features from other coin offerings).

interviewees say. This requires, among other things, more “technologists” at higher levels in the SEC.

One regulator—while acknowledging the significant potential of DLT to transform securities markets—commented that regulatory fragmentation and complexity are disproportionately burdensome for smaller innovators, who usually lack the resources to navigate such complexity.

One member of the broker-dealer community thought that regulations that impact on the use of DLT should be based more on principles and updated frequently. However, there may be a clash of cultures here. As one member of the regulatory community explained, it is not easy to convince the SEC to give prospective policy guidance in a changing landscape—regulators may be much more comfortable making policy through ex-post enforcement. However, not every interviewee was so critical of the SEC in this regard. One member of the broker-dealer community thought that regulators had demonstrated openness to innovation and willingness to learn about new technology such as robo-advising, pointing to the SEC’s approach to cybersecurity regulations—publishing principles-based guidance that is then iteratively refined¹⁵¹—as promising. Regulatory sandboxes, where select players are given regulatory relief for a period of time but monitored to see how things turn out, have also been mentioned as possible ways to make regulators more comfortable with innovation.¹⁵² However, concerns were raised that regulators would not have adequate resources to monitor companies’ activities in sandboxes. Interestingly, one member of the investment community thought that it was more difficult to petition the SEC for permission to do something unusual in the United States than it was to petition regulators in other jurisdictions, and so a study of the

¹⁵¹ See *Cybersecurity*, U.S. SEC. & EXCH. COMM’N, <https://www.sec.gov/spotlight/cybersecurity> [<https://perma.cc/9BPV-BCG7>] (collecting and updating SEC cybersecurity guidance).

¹⁵² For an overview of regulatory sandboxes, see Chris Brummer & Yesha Yedav, *Fintech and the Innovation Trilemma*, 107 GEO. L.J. 235, 291–97 (2019).

successes and failures of sandboxes in these other jurisdictions would be worthwhile.

The industry's distrust of regulators' technological capacity is also a significant impediment to progress. The debate around source code reflects this, as one former regulator told us: Regulation Automated Trading originally proposed that HFTs reveal their source code, but this received major criticism because the industry did not trust the government with members' source code—even in light of a subpoena or court order.¹⁵³

Looming over these issues is the failure of a fragmented regulatory system to keep pace, and the resulting negative repercussions for overall economic efficiency. For example, conversations with regulators revealed concerns that the SEC is ill-equipped to address antitrust issues raised by the concentration of shareholder power in a few massive institutional investors,¹⁵⁴ while the FTC and DOJ, America's traditional antitrust regulators, are not qualified to address securities issues. Similar problems may arise if DLT-based trading creates some kind of monopoly. Other interviewees raised the example of FINRA lacking adequate reach into the futures markets even though manipulative schemes can easily involve an interaction between the futures and securities markets. From an industry standpoint, one member of the broker-dealer community explained that, though the goal was to make sure all relevant regulators were comfortable, identifying the proper regulator was sometimes difficult. But whether regulatory consolidation would help is unclear. One regulator suggested that fragmented regulators can learn from each other's mistakes, and another member of the regulatory community questioned the wisdom of

¹⁵³ Gregory Meyer, *US Regulator Declares 'Dead' Moves To Seize HFT Code*, FIN. TIMES (Oct. 4, 2017) (on file with the Columbia Business Law Review), <https://www.ft.com/content/068ce050-a922-11e7-93c5-648314d2c72c>.

¹⁵⁴ On this concentration, see John C. Coffee, Jr., *The Future of Disclosure: ESG, Common Ownership, and Systematic Risk*, 2021 COLUM. BUS. L. REV. 606 & n.6.

combining the SEC and CFTC because they regulate very different markets. Yet two other regulators thought fragmentation was clearly harmful and did not think that agencies would work together better until Congress changed its system having a different committee oversee each agency, with each jealously guarding its prerogatives.

Other regulators raised concerns that SEC enforcement is hampered by its slow adjustment to both technological change and globalization. As one member of the regulatory community put it, very few people at the SEC are skilled in programming and handling big data or DLT, and, as a result, they may not realize that they can be flying blind with respect to important kinds of activities in need of regulation. Another suspected that the SEC and FINRA will need to hire technical auditors.

Finally, the design of the right securities regulatory reaction to the potential for DLT cannot be based on the assumption that the U.S. market exists in isolation from the rest of the world. Technology has made it far easier to invest in the stocks of foreign issuers and, following the advice of financial economists, a larger and larger portion of U.S. individual investors' portfolios is composed of foreign stocks.¹⁵⁵ But even where the foreign companies in which Americans invest are registered under the U.S. securities laws, problems remain. As one member of the regulatory community noted, regulators lack effective ways to obtain the audit papers of corporations in many countries in order to detect fraud against U.S. investors. Nor did this interviewee like the idea of allowing companies in which Americans invest to simply comply with the rules of foreign jurisdictions, which he feared would lead to a race to the bottom. This underlines the importance of cooperation among regulators around the globe if the issues raised by DLT are to be effectively dealt with.

¹⁵⁵ See Nicolas Coeurdacier & Hélène Rey, *Home Bias in Open Economy Financial Macroeconomics*, 51 J. ECON. LITERATURE 63, 63–67 (2012) (noting a gradual decline in portfolio “home bias” over time).

XII. CONCLUSION

Our Stakeholder Survey interviews have introduced and explored a rich variety of issues faced by securities markets regarding the possible uses of DLT. While it is easy to imagine many ways that DLT could transform the securities markets, the future is not clear. Some of the uncertainty is due to simply not knowing whether the technology is really applicable in the ways, and with the advantages, imagined. Part, though, will depend on the reactions of regulators. Can they get out of the way where an existing regulation would impede DLT's utilization and the regulation's application to the DLT-based practice serves no useful purpose? Can they step in with new regulation where DLT would permit the evasion of rules that currently achieve worthwhile aims? And can they nudge the incumbent players, who have established patterns of interaction in making the current market function, to cooperate to make work whatever new DLT-based systems in fact turn out to be practical and socially desirable?

XIII. APPENDICES

Appendix A: June 25, 2019 Roundtable Attendees

Mary Ann Callahan – *Managing Director, Office of Technology Architecture, State Street Corporation*

Robert Farrokhnia – *Adjunct Associate Professor of Business, Columbia Business School*

Yulia Guseva – *Professor of Law, Rutgers Law School*

Jared Herman – *President, Hedgebay Securities LLC*

Reynolds Holding – *Senior Fellow, Columbia Law School*

Jared Klee – *Blockchain Offering Manager, Digital Assets, IBM*

Chuin Lee – *Managing Director, Bank of America*

Pam Marcogliese – *Partner, Freshfields Bruckhaus Deringer*

Will Martino – *Founder & CEO, Kadena*

Ryne Miller – *Partner, Sullivan & Cromwell LLP*

Joshua Mitts – *Associate Professor of Law, Columbia Law School*

Justin Schmidt – *Head of Digital Asset Markets, Goldman Sachs*

Rosie Shen – *Goldman Sachs*

Drew Van der Werff – *Goldman Sachs*

David Wishnick – *Academic Fellow, University of Pennsylvania Law School*

Appendix B: Survey Interviews Conducted to Date

Program in the Law and Economics of Capital Markets as of February 21, 2021: Interviews Conducted (Positions as of the Date of the Interview)

Erkin Adylov – *Founder and CEO, Behavox*

Ben Alden – *Former Chief Legal Officer & General Counsel, Betterment LLC; Chief Risk Officer, Vanguard*

Amar Amlani – *Executive Director, Goldman Sachs*

Elita Ariaz – *Legal Executive Superintendent - Business, Banco Santander*

Marcelo Barbosa – *President, Comissão de Valores Mobiliários (CVM) (the Brazilian Securities Commission)*

Brandon Becker – *Managing Director & Deputy General Counsel, The Depository Trust & Clearing Corporation*

Ken Bensten – *President and CEO, SIFMA*

Ran Ben-Tzur – *Partner, Fenwick & West*

Max Berger – *Founding Partner, Bernstein Litowitz Berger & Grossmann*

Edward Bernard – *Chairman of Asset Management Advisory Committee, SEC*

Ken Bertsch – *Executive Director, Council for Institutional Investors*

Michael Brown – *Partner, Fenwick & West*

Chris Brummer – *Professor, Georgetown Law*

Doug Cifu – *CEO, Virtu Financial Inc.*

Jay Clayton – *Former Chair, SEC*

Diwa Cody – *Broker, Goldman Sachs*

Robert Cohen – *Partner, Davis Polk & Wardwell and Former Chief of Cyber Enforcement Unit, SEC*

Bob Colby – *Chief Legal Officer, FINRA*

Chris Concannon – *President and COO, MarketAxess*
Benjamin Connault – *Economist, IEX*
Robert Cook – *President & CEO, FINRA*
John Cosenza – *Head of Americas Electronic Trading,
Goldman Sachs*
Abe Curdumi – *CEO, 5th Street Advisors*
Dorothy DeWitt – *Director, Division of Market Oversight,
CFTC*
Jim Doty – *Former Chairman, PCAOB*
Amy Edwards – *Assistant Director, Division of Economic and
Risk Analysis, SEC*
Shelley Eleby – *Director, Clearpool Group*
Nigel Faulkner – *Head of Global Technology/CTO, T. Rowe
Price*
Adam Fliss – *General Counsel, TPG Capital*
Dan Gallagher – *Partner, WilmerHale and Former
Commissioner, SEC*
Tyler Gellasch – *Executive Director, Healthy Markets
Association*
Gustavo Gonzalez – *Director, Comissão de Valores Mobiliários
(CVM)*
Adrian Griffiths – *Assistant General Counsel, CBOE Global
Markets*
Frank Hatheway – *Former Chief Economist, NASDAQ OMX
Group Inc.*
Jared Herman – *President, Hedgebay Securities LLC*
Bill Hinman – *Director, Division of Corporate Finance, SEC*
Melissa Hinmon – *Director of Equity Trading, Glenmede
Investment Management*
Christopher Iacovella – *CEO, American Securities Association*
Adam Inzirillo – *Head of U.S. Equities, CBOE*
Robert Jackson – *Commissioner, SEC*
Marc Jaffe – *Partner, Latham & Watkins*
Jim Katzman – *Former Partner, Goldman Sachs*
Dennis Kelleher – *President & CEO, Better Markets*
Rick Ketchum – *Former CEO, FINRA and Former Director,
Division of Market Regulation, SEC*
Mehmet Kinak – *Global Head of Systematic Trading &
Market Structure, T. Rowe Price*

Dave Kling – *Deputy General Counsel, Facebook*
Jiří Król – *Deputy CEO, Global Head of Government Affairs, AIMA*
Jonathan Lavine – *Co-Chair, Bain Capital*
Sophia Lee – *General Counsel, IEX*
Julius Leiman-Carbia – *Chief Legal Officer, Wealthfront*
Shen Liping – *Partner, Allbright Law Offices*
Temmy Lizarzabal – *Managing Director & Co-Head of North America Financial Institutions, Citigroup*
Simon Lorne – *Vice Chairman & Chief Legal Officer, Millennium Management LLC*
Matthew Mallow – *Vice Chairman, BlackRock*
Michael Mann – *Partner, Richards Kibbe & Orbe*
Monica Martinez – *Senior Counsel, Banco Santander*
Andy McCarroll – *General Counsel, Southeastern Asset Management*
Mathew McDermott – *Managing Director & Global Head of Cross Asset Financing, Goldman Sachs*
William McNabb – *Former Chairman & CEO, Vanguard*
Maria Newport – *Analyst, Goldman Sachs*
Brian Nigito – *Jane Street Capital*
Eric Pan – *Former Director, Office of International Affairs, CFTC*
Troy Paredes – *Former Commissioner, SEC*
Hester Peirce – *Commissioner, SEC*
Catarina Pereira – *Chief of Staff, Comissão de Valores Mobiliários (CVM)*
Jennifer Peve – *Managing Director of Business Innovation, DTCC*
Mike Piwowar – *Former Acting Chairman, SEC*
Marta Poleszczuk – *Vice President, Goldman Sachs*
Steve Randich – *Executive Vice President & Chief Information Officer, FINRA*
Brett Redfearn – *Director of the Division of Trading & Markets, SEC*
Greg Rodgers – *Partner, Latham & Watkins*
Barbara Roper – *Director of Investor Protection, Consumer Federation of America*
Ray Ross – *Managing Director, Clearpool Group*

Ari Rubenstein – *Co-Founder & CEO, GTS*
Wyatt Russo – *Vice President, Goldman Sachs*
Doug Schrank – *Head of Trading, Southeastern Asset Management*
Jameson Schriber – *Partner, Goldman Sachs*
Jay Schulman – *National Leader, Blockchain and Digital Assets, RSM US LLP*
Jeffrey Solomon – *CEO, Cowen Inc.*
Larry Sonsini – *Founding Partner, Wilson Sonsini Goodrich & Rosati*
Colin Stretch – *Former General Counsel, Facebook*
Jatin Suryawanshi – *Managing Director & Head of Global Quantitative Strategy, Jefferies Financial Group*
Aron Szapiro – *Head of Policy Research, Morningstar*
Ken Trippe – *Director of Private Investments, Glenmede Investment Management*
Greg Tusar – *Cofounder, Tagomi Systems*
John W. White – *Partner, Cravath, Swaine & Moore and former Director, Division of Corporate Finance, SEC*
Edward Waitzer – *Professor, Osgoode Hall Law and former Partner, Stikeman Elliott*
Joe Wald – *Managing Director, Clearpool Group*
Steven Wallman – *Former Commissioner, SEC*
Elisse Walter – *Former Chairman, SEC*
Russel Wermers – *Director, Center for Financial Policy, Smith School of Business, University of Maryland*
John Whelan – *Managing Director of Digital Investment Banking, Banco Santander*
Bill White – *CEO, ClearList*
Mary-Jo White – *Former Chair, SEC and Partner, Debevoise & Plimpton*
Bill Williams – *Of Counsel, Sullivan & Cromwell*
Haimera Workie – *Head of Financial Innovation & Senior Director, FINRA*
Eddy Wymeersch – *Former Chair, Committee of European Securities Regulators*

Appendix C: Questions Sent Stakeholder Survey

Interviewees in Advance

Background Questions – Capital Markets Operations

- What in your view are the biggest problems, if any, of today's capital markets?
 - Please discuss in terms of (a) facilitating capital formation, (b) liquidity to end-users, (c) accurate price discovery, and (d) cost-of-operations.
- Are there aspects of the functioning of our securities markets that you view as operating unfairly with regard to you or any other group of people?

Impact of Technological Innovation

- Over the next decade or so, how do you think technology will affect the functioning of capital markets in aspects with which you are familiar?
- To what extent and in which specific ways are the capital markets subject to cyber security threats and what steps do you think can be taken to ameliorate any such threats?
- Over the length of your career, how has technology affected your job and the functioning of capital markets in the aspects with which you are familiar?
- Over the length of your career, how have new financial products enabled by technology affected your job and the functioning of capital markets in the aspects with which you are familiar?
- In what way, if any, has globalization affected the functioning of capital markets in aspects with which you are familiar?
 - How do you foresee globalization affecting the functioning of the capital markets over the next decade or so?

Impact of Distributed Ledger Technology

- Please reflect on the impact, if any, that digital ledger technology is already having in your day-to-day work, as well as how you anticipate that it will impact your work in the future. In particular, please describe the challenges this technology is

posing to your historic ways of doing business and how you expect your business to adapt. More generally, how do you think that the technology will, going forward, affect the market in which you operate and its regulation?

- How might digital ledger technology help or hurt in terms of the capacity of securities markets to facilitate capital raising for both small market-cap firms and large market-cap firms?
- How might ledger technology help or hurt in terms of the capacity of securities markets to provide liquidity to end users, accurate price discovery, and cost-of-operations?
- How do you think digital ledger technology is going to affect the prevalence of cross border securities transactions and what do you think its effect will be on the effectiveness of regulation with respect to such transactions?

Regulation

- To the extent that your answers to any of the preceding questions suggest problems, what sort of additional regulation or deregulation, if any, would be an appropriate response?
- Are there illegal practices occurring in the market that in your view are subject to inadequate enforcement?
- Are there practices occurring in the market that in your view could benefit from additional regulatory clarity?
- With respect to digital ledger technology specifically, what aspects of the market in which you operate do you believe are most in need of regulatory clarification? Are there projects you would like to undertake or applications of digital ledger technology that are currently unfeasible due to regulatory uncertainty? What questions would you most like answered?
- How, in your view, would regulatory sandboxes facilitate understanding of advancing technology?

Next Steps

- What, to you, are the most important questions concerning the functioning of securities markets for which adequate answers have not yet been provided?
- How have your answers to the other survey questions been especially informed by your particular experiences and/or data to which you have access that is not publicly available?
- Who else in or outside of your organization should we talk to regarding the issues we have discussed?