DATA MARKET DISCIPLINE: FROM FINANCIAL REGULATION TO DATA GOVERNANCE

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Abstract: Privacy regulation has traditionally been the remit of consumer protection, and privacy harm is cast as a contractual harm arising from the interpersonal exchanges between data subjects and data collectors. This frames surveillance of people by companies as primarily a consumer harm. In this article, we argue that the modern economy of personal data is better understood as an extension of the financial system. The data economy intersects with capital markets in ways that may increase systemic and systematic financial risks. We contribute a new regulatory approach to privacy harms: as a source of risk correlated across households, firms and the economy as a whole. We consider adapting tools from macroprudential regulations designed to mitigate financial crises to the market for personal data. We identify both promises and pitfalls to viewing individual privacy through the lens of the financial system.

Keywords: *privacy; data governance; financial regulation; big data; surveillance; data economy*

I. Introduction

Due to the well-documented failures of the notice-and-choice regime to regulate consumer privacy and discipline the excesses of data extraction, privacy scholars have turned to other domains, such as environmental law and public health law, for inspiration about new regulatory paradigms for data governance.[1] This article presents financial regulation as one such paradigm. The connection between markets for personal data and financial markets is not merely metaphorical. Modern personal data markets have from their beginning been intertwined with personal credit

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1 See, eg, Julie Cohen, *Between Truth and Power* (New York, NY: Oxford University Press, 2019).

scoring and corporate stock valuations. The entanglement of financial markets and the market for personal data not only presents conceptual challenges, but it also offers an opportunity for data governance law to draw from financial regulations and adapt them to the context of data markets.

We argue that macroprudential concerns about market volatility motivate stronger disclosure requirements for systemically significant actors in the data economy. These disclosures can then facilitate the enforcement of other complementary privacy rules. The notice and consent regime's inability to protect privacy, to secure against informational harm and to limit flows of data extraction is, by now, well established.[2] Notice and consent's emphasis on personal control at the point of collection aligns poorly with contextually specific concerns over appropriate information flow and the reality of digital settings designed explicitly to extract data from users.[3] In short, notice and consent regulates the terms of an interpersonal exchange (between data subject and data collector); this does not fully account for the imperatives (and regulatory concerns) of data about people being produced as a core economic activity in the digital economy.[4] To address that gap, a growing number of scholars have posited the need for a new regulatory paradigm for data governance. For inspiration, scholars have turned to other regulatory domains, such as public health and environmental regulation, which are better equipped to address the structural and systemic issues that accompany the transformation of information about people into a commercialised and standardised data product.[5]

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2 This shortcoming has been given an exhaustive treatment by many privacy scholars. Neil M Richards and Woodrow Hartzog provide a useful typology, categorising the different ways consent fails to secure privacy in the digital context. See "The Pathologies of Digital Consent" (2019) 96:6 *Washington University Law Review* 1461. Elettra Bietti provides a helpful exploration of the normative stakes of this failure. See "Consent as a Free Pass: Platform Power and the Limits of the Informational Turn" (2020) 40:1 *Pace Law Review* 310. Privacy policies are often long and written in legal jargon. They are also pervasive throughout the consumer web. One study from 2008 found that it would take an average user 76 days to read all the privacy policies they encountered in one year alone, with a nationwide annual estimated opportunity cost of $781 billion. See Aleecia McDonald and Lorrie Cranor, "The Cost of Reading Privacy Policies" (2008) 4:3 *A Journal of Law and Policy for the Information Society* 543. As a result, privacy policies are in fact not read by consumers. See JA Obar and Aa Oeldorf-Hirsch, "The Biggest Lie on the Internet: Ignoring the Privacy Policies and Terms of Service Policies of Social Networking Services" (2020) 23:1 *Information, Communication & Society* 128–147. Because consumers cannot be fully informed of the stakes of their online agreements, the price mechanism of these markets fails. See Katherine J Strandburg, "Free Fall: The Online Market's Consumer Preference Disconnect" (2013) 2013:5 *University of Chicago Legal Forum* 95.

3 For an overview of the contextual integrity theory of privacy, see Helen Nissenbaum, *Privacy in Context: Technology, Policy, and the Integrity of Social Life* (Palo Alto, CA: Stanford University Press, 2010). See also Madelyn Sanfilippo, Brett Frischmann and Katherine Standburg, "Privacy as Commons: Case Evaluation Through the Governing Knowledge Commons Framework" (2018) 8:1 *Journal of Information Policy* 116; Solon Barocas and Helen Nissenbaum, "Big Data's End Run around Anonymity and Consent" in J Lane, V Stodden, S Bender and H Nissenbaum (eds), *Privacy, Big Data, and the Public Good: Frameworks for Engagement* (Cambridge: Cambridge University Press, 2014) p. 44.

4 Ari Ezra Waldman, "Privacy Law's False Promise" (2019) 97:3 *Washington University Law Review* 773; Woodrow Hartzog, *Privacy's Blueprint* (Boston: Harvard University Press, 2018).

5 See eg Dennis Hirsch and Jonathan King, "Big Data Sustainability: An Environmental Management Systems Analogy" (2016) 72:3 *Washington and Lee Law Rev*iew 406; Dennis Hirsch, "From Individual

This article presents the case for drawing inspiration from financial regulation as another such paradigm. But whereas other regulatory domains have been used as metaphors to expand consumer data law, there is a long-standing relationship between privacy and finance, especially credit, that has deepened and matured over time. For example, in the 1990s, data brokers harvested personal data from public records for use in credit risk assessment. With time, this practice expanded. Now technology-forward lending companies aggressively use personal data on everything, including social media usage, utility payment records, psychometric tests and how diligently a data subject keeps his or her phone charged.[6] In August 2020, the International Monetary Fund (IMF) released a working paper in which researchers argued in favour of using data from browsing, search and purchase history to create more accurate credit ratings for individuals and businesses.[7] In essence, pervasive data subject surveillance allows lenders to measure what JP Morgan, a century ago, called the primary basis of credit—a person's character.[8] We argue that the further development of the data economy, such as digital advertising, extends evaluation of subjects' character. Assessment regarding the likelihood of future repayment is expanded into a more generalised actuarial assessment of subjects' future behaviour and actions.

Personal data markets are best seen as an unregulated extension of the financial sector, one which is currently rife with speculation due to uncertain asset quality. We propose several regulatory interventions that build on existing financial regulation and are adapted to the specific qualities of personal data.

Section II examines the rise of the personal data market and its connection to financial risk. Data brokers arose in part because of the demand for personal information by credit scoring agencies. Later, electronic exchanges successfully securitised consumer behaviour through targeted digital advertising, creating a new way to monetise personal information.

Section III reviews in brief the financial system and its associated risks that motivate regulatory intervention. Such risks include asset bubbles, the speculative rise and abrupt fall of an asset price. The resulting volatility can interact with correlations between firm losses, or *systemic risk*, to cause financial crises. Two

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Control to Social Protection: New Paradigms for Privacy Law in the Age of Predictive Analytics" (2019) 79:2 *Maryland Law Review* 439; Luke Stark, "Start Treating Private Personal Data on Facebook Like Medical Data: It's Just as Sensitive to Nefarious Manipulation" *NY Daily News* (23 March 2018), available at https://www.nydailynews.com/opinion/start-treating-private-personal-facebook-data-medical-data-article-1.3891871 (visited 30 August 2021).

6 "How Keeping Your Phone Charged Might Help Boost Your Credit Score" *Bloomberg News* (New York, 16 November 2015).

7 Arnoud WA Boot, Peter Hoffmann, Luc Laeven and Lev Ratnovski, "Financial Intermediation and Technology: What's Old, What's New?" (IMF Working Paper Series, August 2020), available at https://www.imf.org/en/Publications/WP/Issues/2020/08/07/Financial-Intermediation-and-Technology-Whats-Old-Whats-New-49624 (visited 30 August 2021).

8 Testimony of John Pierpont Morgan before the Bank and Currency Committee of the House of Representatives (18 December 1912) 5, available at http://memory.loc.gov/service/gdc/scd0001/2006/20060517001te/20060517001te.pdf (visited 30 August 2021).

such crises, the Great Depression and the 2008 financial crisis both spurred new financial regulation to impose market discipline on excessive risk-taking behaviour and manage systemic risk. These interventions have been beneficial to investors because of how they mitigate *systematic risk*, correlated risk across an entire market that cannot be mitigated by diversification. In theory, this also benefits ordinary people in the economy more broadly, by reducing volatility in financial markets and mitigating the broader economic fallout which may result.

Section IV presents the heart of the argument. Today personal data markets serve as an extension of the financial system, introducing many covert vectors for market correlations via assets of uncertain quality. We outline the macroeconomic logic of these opaque and unaccountable information flows and how they introduce an unknown amount of systemic and systematic risk to the market. This motivates regulatory interventions into the personal data economy motivated by macroprudential considerations. By focusing on the role of personal data in the financial system, we illuminate new regulatory goals and strategies. Rather than focus on tangible harms to consumers, we can instead reflect on how personal data markets are connected to financial risk at the levels of the consumer, the firm and the whole economy. This expands the range of stakeholders in data protection regulation beyond consumers to investors more broadly. We propose that macroprudential concerns aimed at improving data market discipline may be attractive to these investors and a carrot for new data market regulations modelled on capital markets regulation. We see this interest in stability of the financial system to be shared between systemically significant institutions and individual consumers. Indeed, much of the motivation to influence institutional behaviour is because of the effect such institutions have on ordinary people—volatility and market failure are of legal relevance because they result in people losing their jobs, their homes and their savings. Market concentration in financial services matters because, when one such institution fails, it can result in large-scale losses for thousands of innocent and ordinary third parties.

At the same time, we recognise that personal data are significant to consumers in many ways beyond their relevance to financial risk. In some cases, the goals of efficient capital allocation may be at odds with legitimate privacy concerns. However, we propose that regulations aimed primarily at macroprudential oversight and market discipline, such as disclosure mandates, would have the secondary effect of making information flows legible to regulators who would improve the enforceability of sectoral privacy rules and data protection legislation. Hence, we aim to design policy proposals that offer the carrot of reduced financial risk while sharpening the stick of exposure to regulatory liability.

II. Data Markets

With the rise of the Internet, new data harvesting tools through widespread consumer electronics, new machine learning profiling tools and electronic exchanges

have enabled the securitisation of consumer behaviour. Like financial instruments whose value derives from expected future behaviour, data-driven services derive financial value from the accuracy of their bets on future consumer behaviour. Moreover, the ability to harvest personal data or provide data-driven services is a key element of the valuation of digital technology (and increasingly other) companies. These connections between personal data, credit, consumer spending and stock value introduce correlated financial risks for households and firms in myriad but opaque ways.

Unlike capital markets, which are hundreds if not thousands of years old, data markets are relatively new phenomena, enabled mainly by the spread of digital technology. Widespread use of the Internet, including smartphones and connected devices, has created many new ways to capture personal data from data subjects. One reason why "data markets" are hard to conceptualise is that these data can, in principle, be used for many purposes beyond the one for which it was originally recorded. To understand data as an asset and how these can be used for purposes with monetary value, we will first consider *data brokers*, companies that aggregate and sell data sets. A great deal of the salience of the data market, however, comes not from data brokers but rather through the uses of data by "Big Tech" platforms such as Google and Facebook. While digital advertising is in many ways a refinement of earlier direct marketing practices, these platforms are notable because they profit from the operation of digital markets for advertising spots. In a separate section, we will consider the contemporary *advertising exchange* as one example of a place where data get monetised.

A. Data brokers and risk mitigation

With the ubiquity of digital technology, a new class of business, *data brokers*, such as Acxiom,[9] arose in the late 20th century. These companies aggregate data from previously undigitised public records as well as private sources to produce valuable data sets about individuals. These data are then organised into "lists" of individuals who share some salient feature or "profiles" based on those features, which are then used by an intermediary to target the individuals. The main uses of the data sold by data brokers include "person search", risk mitigation and marketing.[10] There are some cases of data provided by data brokers used for "person search"—an individual using data to track down another individual—and these are salient to the analysis of the privacy implications of data brokers; however, person search is a rather small part of the overall data market. We will focus on the much larger, institutional

9 Natasha Singer, "Acxiom, the Quiet Giant of Consumer Database Marketing" *The New York Times* (New York, 16 June 2012) 17.

10 Federal Trade Commission, "Data Brokers: A Call for Transparency and Accountability" (May 2014), available at https://www.ftc.gov/system/files/documents/reports/data-brokers-call-transparency-accountability-report-federal-trade-commission-may-2014/140527databrokerreport.pdf (visited 13 August 2014).

uses of personal data for risk mitigation and marketing. The major risk mitigation uses of personal data tie the data market into capital markets. Profiles are used to inform credit scores, which determine the variable availability and price of credit to individuals, or to inform actuarial insurance practices, pricing the insurance of individuals based on their expected risk. This relationship between data markets and capital markets is fundamental. Personal credit and insurance (eg disability insurance) are both ways in which an individual's future earnings are securitised and managed as tradable assets. As with all securities, the market for insurance and personal credit is characterised by risk. Personal data provided by data brokers are used to manage this risk by informing pricing. Analogous to stock markets, personal data are a way to calibrate the "trading strategy" or pricing of other financial assets; they are only secondarily valuable as an asset in their own right.

Some personal data are barred from use in these risk mitigation applications. The Fair Credit Reporting Act (FCRA) regulates consumer reporting agencies in service of the accuracy of information and privacy of consumers.[11] The Health Insurance Portability and Accountability Act (HIPAA) regulates the use of health information by covered entities in part to prevent its misuse by insurance companies.[12] Many privacy and artificial intelligence ethics concerns can be understood in terms of the (sometimes disparate) impact of novel uses of personal data on household and consumer finances.

B. Data for marketing and advertising exchanges

Many data brokers produce market products, which help match marketing messages (advertisements) to consumers who will be receptive to those messages. In practice, data about consumers are used to create "profiles" or market segments,

11 FCRA (15 USC § 1681; 84 Stat. 1127) is one of the earliest US data protection laws. First enacted in 1970, FCRA regulates consumer reporting agencies, users of consumer reports and furnishers of consumer information and protects consumers from the wilful and/or negligent inclusion of inaccurate information in their credit reports. To that end, FCRA regulates the collection, dissemination and use of consumer information, including consumer credit information. It states that users of consumer credit reports may only use them for purposes permissible under FCRA, must notify consumers if an adverse action is taken on the basis of such reports and must identify the company that provided the consumer report so that consumers may verify or contest the accuracy and completeness of their consumer report.

12 Passed in 1996, HIPAA (Pub. L. 104–191; 110 Stat. 1936) was enacted to modernise the flow of healthcare information in the US healthcare system; it stipulates how personally identifiable information maintained by the healthcare and healthcare insurance industries should be protected and addresses the limitations on healthcare insurance coverage. Title II contains HIPAA's two main data protection provisions: the Privacy Rule and the Security Rule. These rules impose a variety of requirements on covered entities that interact with personal health information (PHI). Broadly, the Privacy Rule limits the circumstances under which PHI may be used, sold or disclosed; establishes patients' right to access their PHI and provides patients a right to amend their PHI if it is inaccurate or incomplete. The Security Rule requires certain entities to adopt administrative, physical and technical safeguards to protect PHI. The groups that must comply with HIPAA are "covered entities", generally healthcare providers and insurance companies, and "business associates", generally companies that provide covered entities with services that necessitate access to personal health data. Congress delegated oversight and enforcement responsibility to the Department of Health and Human Services.

such as "African-American Professional", "New Age/Organic Lifestyle" or "Leans Left". In direct marketing, consumers fitting a profile will be contacted with the marketing message directly. This is perhaps the simplest use of personal data for marketing. Through the consumer Internet, this practice has evolved into forms that use more contextual and behavioural data. Implicit in this kind of probabilistic or actuarial marketing is a new kind of securitisation: the securitisation of consumer behaviour in response to a marketing message.[13] The decision to advertise to a consumer in a particular context is not only an opportunity to induce some behaviour—typically, the purchase of a product—but also a costly act. As in the case of risk mitigation, personal data are used to influence strategy with respect to the securitised asset of consumer behaviour.

Just as the securitised credit and equity in companies are traded in sophisticated exchanges, so too with securitised consumer behaviour. Today, the most prominent advertising exchanges are run by Google and Facebook, though there are also exchanges run by Verizon, Microsoft and other major Internet companies. The comparison between the ad exchange and the stock market is explicit in Google's description of AdX (or Ad Exchange, formerly Doubleclick Ad Exchange): "By establishing an open marketplace where prices are set in a real-time auction, the Ad Exchange enables display ads and ad space to be allocated much more efficiently and easily across the web. It's just like a stock exchange, which enables stocks to be traded in an open way".[14] In a typical prominent ad exchange with real-time bidding, when a user requests content from a publisher, the publisher will communicate with a *supply side platform* (SSP) which combines data about the user available to the publisher through its customer relationship management system, through other cookies and from third-party data sources (such as those available from a data broker). The SSP sends the offer of ad space with information about the user who will view it to the ad exchange. The ad exchange then floats the offer on demand side platforms on which ad agencies bid for the ad space. The winning bidder buys the ad space. The ad exchange passes the ad back through to the publisher, who shows it to the user. In sum, the SSP improves the ad space offer by annotating it with user data that have been collected by the publisher, "second parties" through web cookies and third parties. The better the SSP articulates the ad space offer in terms of meaningful user profiles, the more ad agencies can be confident about the value of the space. The advertising market utilises user data to improve its efficiency.

The abstract asset being exchanged on the ad exchange is priced according the precise, concrete metrics. Online advertisers have the option of paying on the basis of Cost per Impression (often, cost of thousands of "impressions" or views of an ad), Cost per Click (a cost per user click on the ad), or Cost per Installation (where

13 Shoshana Zuboff, "Big Other: Surveillance Capitalism and the Prospects of an Information Civilization" (2015) 30:1 *Journal of Information Technology* 75.

14 "The DoubleClick Ad Exchange" *Google*, available at https://static.googleusercontent.com/media/www.google.com/en//adexchange/AdExchangeOverview.pdf (visited 14 December 2020).

the payment is made only when the user install an advertised mobile app), or more generally Cost per Action (CPA) or Cost per Conversion (the advertiser pays on the basis of the number of actions taken by the user, which could be a subscription to a newsletter or a purchase). The opportunities for measurement in online advertising sometimes make it possible to track not just who views an ad but how that user responds to it and to price accordingly. However, this is not always the case. Especially for "considered purchases", such as the purchase of a home or car, for which a consumer typically does not respond immediately to an advertisement, advertisers face a problem of attribution: How can they know if their advertisement caused a purchase? This attribution problem colours the relationships between advertisers, exchanges and suppliers. The latter have incentive to inflate the effectiveness of the advertisements by, for example, showing them to consumers who are likely to purchase the product regardless of the advertisement. Excessively fine targeting in advertising markets introduces adverse selection and monetisation hazards that can reduce overall efficiency.[15] Data markets, and online advertising markets in particular, collect and employ user data in several different ways. On the supply side, user data are being drawn from multiple sources, including third parties, in order to improve the ad space offer. But user data—behavioural data—is also collected after the ad is shown in order to determine pricing. The supply and demand side is essentially betting on user's behaviour, which in the case of CPA or Cost per Conversion (CPC) is a securitised activity that is milliseconds in the future of the exchange transaction. Furthermore, advertisers may collect user data using their own cookies or third parties in order to validate the claims made by ad exchanges about ad efficacy. The misaligned incentives and information asymmetries between different actors in the digital advertising economy therefore create the conditions for multiple, redundant paths of data harvesting from users as the parties second guess each other.

C. Legal challenges and liability

Consumers are generally not always aware of how extensively and pervasively their data are used in the market, are uncomfortable when this is revealed and have expectations that are not in line with the information-sharing practices used by companies.[16] These concerns have prompted regulators to introduce new privacy regulations that restrict the use of personal data collected online. Recent notable data protection laws along these lines include the European Union (EU)'s General Data Protection Regulation (GDPR), renowned for its steep penalties and extraterritorial enforcement, and the California Consumer Privacy Act (2018), which contains strong language about the purchase and sale of data, making these practices

15 Jonathan Levin and Paul Milgrom, "Online Advertising: Heterogeneity and Conflation in Market Design" (2010) 100:2 *American Economic Review* 603.

16 Chris Jay Hoofnagle and Jennifer King, "Consumer Information Sharing: Where the Sun Still Don't Shine" *SSRN* (17 December 2007), available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1137990 (visited 28 May 2021).

more explicit to users in their privacy notifications.[17] Some scholarship suggests that these regulations reduce the effectiveness of targeted advertising.[18] This reduction may be intentional, as a purpose of these regulations is to reduce the reliability and availability of third-party data that would be used by the SSPs to augment ad space offers. Legislation along these lines seeks to more firmly guarantee consumer's control over their data's use on mainly dignitarian grounds, but mainly does not contest the use of consumer data for risk management and marketing if consumers accept the terms of the use. This has led to the rise of consent management platforms, attempts by the advertising industry to scale up and commodify the process of acquiring consent.[19]

Because of the ambiguity of rules like the GDPR, along with its stiff penalties (up to 4 per cent of company profits), the potential misuse of personal data has become a significant source of potential liability. As a result, privacy practices are scrutinized as routine part of merger and acquisition negotiations. It can no longer be taken for granted that holding personal data will be a source of value. Today, it can easily be a liability, conditional on there being adequate enforcement.

Last, some uses of personal data in digital marketing have been challenged on antitrust grounds. Consumer behavioural data are used by major online platforms *both* for informing the pricing strategies within advertising exchanges *and* for the large-scale experimentation to improve their platforms to make them more attractive to consumers who would be exposed to advertising.[20] Not only are consumers in an asymmetric information position with respect to these markets, so too are many of the customers of the platforms, such as advertisers on the demand side of the ad exchange. Srinivasan has argued that by owning the exchange and other sides of the market, Google has achieved its anticompetitive dominance in advertising by exploiting information asymmetries and timing sensitivities in its electronic exchanges.[21] Trading intermediaries in electronic markets have the option of using the information about trade demand from third-party buyers and sellers in the interest of their customers or in their own interest. The 1934 Act, implemented

17 The GDPR, which was adopted in 2016 and became enforceable in May 2018, supersedes the 1995 Data Protection Directive and comprises the current regulatory framework for fundamental data protection and privacy rights in the EU and European Economic Area (EEA) as well as for the transfer of personal data outside the EU and EEA. Broadly, the regulation requires that controllers and processors of personal data put into place appropriate technical and organisational measures to implement data protection principles. It also delineates the rights of data subjects, including the right to transparency, right of access, right of rectification and erasure and the right to object to an automated decision. The GDPR is a sweeping and complex law; for an overview, see Meg Leta Jones and Margot Kaminski, "An American's Guide to the GDPR" (2020) 98:1 *Denver Law Review* 93.

18 Avi Goldfarb and Catherine E Tucker, "Privacy Regulation and Online Advertising" (2011) 57:1 *Management Science* 57.

19 Maximilian Hils, Daniel W Woods and Rainer Böhme, "Measuring the Emergence of Consent Management on the Web" (2020) *Proceedings of the ACM Internet Measurement Conference* 317.

20 Julie Cohen, "Law for the Platform Economy" (2017) 51:1 *UC Davis Law Review* 133.

21 Dina Srinivasan, "Why Google Dominates Advertising Markets" (2020) 24:1 *Stanford Technology Law Review* 55.

to correct the unfair uses of trading information by the market, prohibits unfair trading practices to "insure the maintenance of fair and honest markets".[22] Another more recent form of financial regulation is against conflicts of interest through the structural separation of exchanges from trading activities.[23]

III. The Financial System: Markets and Risks

The market for personal data has developed as an extension of financial markets and institutions and may be a source of additional unrecognised systemic and systematic risks. To develop this argument regarding *data markets* and *data market risks*, we must first define and synthesize core concepts regarding *financial markets* and how their interrelated dynamics may result in *financial market risks*. This section outlines key financial concepts and dynamics. It then describes how financial crises can emerge from the interactions between these institutions. Using the Great Depression and the 2008 financial crisis as illustrations, we show how speculation over assets can lead to asset price bubbles, systematic risk and systemic risk. A century of experience with financial markets has informed financial regulations aimed at reducing systematic and systemic risks through disclosure mandates, stress testing and other interventions that impose market discipline.

A. Financial markets

(i) Stock markets

Equity or stock markets refer specifically to the markets where equities in companies are bought and sold. Not all transferable stock is traded on a public exchange: private company stock is bought and sold among venture capitalists, private equity firms, bespoke investors and other financial entities. However, the expanded capital-raising capacity of publicly traded stock remains attractive for many companies. Public trading enables firms to solicit capital from a wider pool of investors, which may in turn allow the price of shares to rise. Publicly traded stock markets serve an additional function: they allow anyone with savings to invest in capital without having the resources to finance entire companies themselves. Historically, the transformation of publicly traded stock markets into a ubiquitous forum for household savings opened up vast new stores of potential investment for companies, while at the same time creating the relatively recent historical phenomena of mass household investment in large-scale corporate enterprises via the public stock market.

22 Securities Exchange (SEC) Act, 15 USC §78b.

23 See FINRA Rules, *Rule 5310: Best Execution and Interpositioning* (last amended 9 May 2014), available at https://www.finra.org/rules-guidance/rulebooks/finra-rules/5310 (visited 30 August 2021). For more discussion on structural separation as a remedy for platform power, see Lina Khan, "The Separation of Platforms and Commerce" (2019) 119:4 *Columbia Law Review* 973.

In the simplest sense, a stock market is a secondary market for stocks that brings together different kinds of market actors. The *issuers* are companies that issue stock, sometimes directly to the market (in case of an Initial Public Offering) or sometimes through their existing shareholders. *Investors* are those who buy (and sell) stock available in public and private securities markets. *Investment intermediaries* like mutual funds, exchange traded funds, institutional investors, private investment funds and hedge funds, institutionalise the aggregation of investment and stock strategies.

(ii) Credit markets and derivatives

Alongside equity, the other primary form of tradable financial assets on securities markets are debt securities, such as debentures, bonds, deposits, notes or commercial paper. Like issuing shares, debt financing offers a way for companies to raise money: as companies grow or take on new ventures, they may issue debt rather than (or alongside) equity. Debt offers companies an attractive alternative to issuing stock for a number of reasons; issuing debt does not dilute ownership in the company, it allows companies to leverage a small amount of capital into a much larger sum (allowing companies to grow more rapidly), and debt is generally tax-deductible.[24] Similar to stock valuation, the terms of any debt issuance depends (in theory) on a company's current and expected future value: these expectations determine how favourable the terms of debt issuance are and how much debt a company may be able to issue. Whereas equity securities are bought and sold in the stock market, debt securities are bought and sold in the bond markets and in other over-the-counter markets where structured debt securities are sold. Companies may issue new debt in the primary bond market, or buy and sell debt securities (including mortgage-backed securities (MBSs) and other asset-backed securities (ABSs) that are otherwise illiquid) in the secondary market.[25] The *credit market* consists of both bonds and bank loans.[26] Unlike public stock exchanges, nearly all US trading of bonds or other debt securities occurs between broker-dealers and large institutional actors in over-the-counter transactions. The derivatives market

24 Internal Revenue Service, "Basic Questions and Answers about the Limitation on the Deduction for Business Interest Expense" (last reviewed or updated 24 September 2020), available at https://www.irs.gov/newsroom/basic-questions-and-answers-about-the-limitation-on-the-deduction-for-business-interest-expense (visited 29 May 2021).

25 Bonds are typically not secured by collateral. ABSs are bonds or notes collateralised by a pool of assets (in the case of MBSs, these assets are mortgages or mortgage-based). ABSs or MBSs offer an alternative for investors to corporate debt—like debt issuances, they generate payments, but they do so from their pool of assets: mortgages, loans, leases, credit card debt or royalties that are otherwise fairly illiquid. See James Chen, "Asset-Backed Security" *investopedia.com* (updated 18 March 2021), available at https://www.investopedia.com/terms/a/asset-backedsecurity.asp (visited 29 May 2021).

26 Bank loans are not considered securities under the Securities and Exchange Act, but bonds usually are subject to securities regulation. Therefore, while both bonds and bank loans comprise the primary markets for company credit, and while both may be traded, they are subject to highly distinct regulatory environments.

is the financial market for financial instruments derived from other forms of assets. Derivatives themselves are contracts that derive their value from the performance of an underlying asset—which may be an equity or debt security, a commodity, an index or an interest rate.[27] Common forms of derivatives include forwards, futures, swaps, options and variations on these more basic forms such as collateralised debt obligations (CDOs) and credit default swaps.[28] Most derivatives are traded either over the counter or via the Chicago Mercantile Exchange.[29]

B. Asset bubbles and risk

Today, capital markets connect the fates of households, through their home and car financing and retirement savings, to the success and failure of public and private firms. Every market actor, in principle, is balancing their desire for returns with their tolerance of risk. Regulators understand this and have tempered the chaotic tendencies of the market accordingly.

In this section we discuss how asset bubbles arise from speculation and increases in the money supply. We also offer two examples of how crashes that result from asset bubbles may result in widespread effects on ordinary households and thus spur the creation of financial regulation in response: the stock market crash of 1929 and the subprime mortgage crisis of 2008. We also trace how asset bubbles can be understood as giving rise to systemic and systematic risks. Asset bubbles and the forms of financial risk they create are relevant to data markets because bubbles capture how the risk-taking behaviour of individual actors in the financial economy may become misaligned with socially optimal amounts of risk-taking for the economy writ large. As we will discuss in greater detail below, similar forms of misalignment between institutional risk-taking and socially optimal risk-taking may also be occurring in the data economy.

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27 Office of the Comptroller of the Currency, US Department of Treasury, "Derivatives", available at https://www.occ.gov/topics/supervision-and-examination/capital-markets/financial-markets/derivatives/index-derivatives.html (visited 29 May 2021) ("A derivative is a financial contract whose value is derived from the performance of some underlying market factors, such as interest rates, currency exchange rates, and commodity, credit, or equity prices. Derivative transactions include an assortment of financial contracts, including structured debt obligations and deposits, swaps, futures, options, caps, floors, collars, forwards, and various combinations thereof").

28 Kristin Johnson, "Things Fall Apart: Regulating the Credit Default Swap Commons" (2011) 82:1 *U. Colorado Law Review* 167, 192 ("While derivative agreements originated in ancient times, swaps are nascent adaptations of traditional derivative contracts. Credit default swaps are among the several classes of swap agreements. Derivative contracts are so described because each type of derivative agreement derives its value from an asset referenced in the contract (the 'reference asset')").

29 Following the 2008 financial crisis, there has been an increased effort to move derivatives trading onto exchanges. See Financial Crisis Inquiry Commission Hearing, Day 1 Transcript (13 January 2010), available at http://fcic-static.law.stanford.edu/cdn_media/fcic-testimony/2010-0113-Transcript.pdf (visited 29 May 2021); (Financial Crisis Inquiry Commission Hearing, Day 2 Transcript (14 January 2010), available at http://fcic-static.law.stanford.edu/cdn_media/fcic-testimony/2010-0114-Transcript.pdf (visited 29 May 2021); Adam Tooze, *Crashed: How a Decade of Financial Crises Changed the World* (London: Allen Lane and New York: Viking, 2018).

(i) Asset bubbles

Asset bubbles describe the phenomena when asset prices appear to be based on improbable beliefs about the future market, closely related to market trading that prices an asset significantly above its intrinsic value.[30]Because it is often difficult to observe intrinsic values in real-life markets, bubbles are often conclusively identified only in retrospect, once the bubble has burst and a sudden drop in prices has occurred. Such a drop precipitates a crash in price, a contraction of credit markets (signalled by rising interest rates), and may lead to widespread economic effects. Asset bubbles are typified by their boom–bust positive-feedback cycles. Crashes are preceded by phases where a number of effects, including excessive access to cheap or easy credit, help drive up asset prices and lead to a bubble.[31] During the growth phases, asset prices grow due to high volumes of bidding, often backed by leveraged positions, further inflating the asset valuations.[32] These increased asset values then become the collateral for further borrowing, used in turn to purchase more assets. This upward spiral pattern between rising asset prices and leveraged positions can cause a *speculative* price bubble to develop.[33] As this upswing in new

30 Paul Krugman, "Bernanke, Blower of Bubbles?" *The New York Times* (New York, 9 May 2013); see also Ronald R King, Vernon L Smith, Arlington W Williams and Mark V van Boening, "The Robustness of Bubbles and Crashes in Experimental Stock Markets" in Richard H Day and Ping Chen (eds), *Nonlinear Dynamics and Evolutionary Economics* (New York: Oxford University Press, 1993).

31 Some economists deny that bubbles occur. See Pete Garber, *Famous First Bubbles: The Fundamentals of Early Manias* (Cambridge, MA: MIT Press, 2001). Those who are convinced that asset prices often deviate strongly from intrinsic value posit various competing causes of bubbles. Common explanations include uncertainty regarding intrinsic value, speculation fuelled by easy access to credit, bounded rationality, processes of price coordination, and sociological factors like emerging social norms and culturally situated narratives. Particular bubbles are often explained using a mix of these potential causes. See Sheen S Levine and Edward J Zajac, "The Institutional Nature of Price Bubbles" *SSRN* (27 June 2007), available at https://ssrn.com/abstract=960178 (visited 28 May 2021); Preston Teeter and Jorgen Sandberg, "Cracking the Enigma of Asset Bubbles with Narratives" (2017) 15:1 *Strategic Organization* 91; Vernon L Smith, Gerry L Suchanek and Arlington Williams, "Bubbles, Crashes, and Endogenous Expectations in Experimental Spot Asset Markets" (1988) 56:5 *Econometrica* 1119; Vivian Lei, Charles N Noussair and Charles R Plott, "Nonspeculative Bubbles in Experimental Asset Markets: Lack of Common Knowledge of Rationality Vs. Actual Irrationality" (2001) 69:4 *Econometrica* 831.

32 Richard P Rumelt, *Good Strategy / Bad Strategy* (New York: Crown Business, 2011).

33 Hyman Minsky typologised the types of borrowing and lending that contribute to a bubble. The "hedge borrower" can make debt payments (covering interest and principal) from current cash flows from investments and is therefore not taking significant risk. The "speculative borrower" uses cash flow from investments to service the debt, but the borrower must regularly roll over, or re-borrow, the principal. The "Ponzi borrower" borrows based on the belief that the appreciation of the value of the asset will be sufficient to refinance the debt but could not make sufficient payments on interest or principal with the cash flow from investments; only the appreciating asset value can keep the Ponzi borrower afloat. Minsky notes that as asset values rise and more agents become highly leveraged, more borrowers may become characterised as Ponzi borrowers: Hyman P Minsky, "The Financial Instability Hypothesis" *Working Paper No*. 74: 6 (28 January 2008), available at http://www.levyinstitute.org/pubs/wp74.pdf (visited 29 May 2021); Hyman P Minsky, *John Maynard Keynes* (New York: McGraw-Hill Professional, 2nd ed., 2008); Hyman P Minsky, *Stabilizing an Unstable Economy* (New York: McGraw-Hill Professional, 2nd ed., 2008). While Minksy's views were never incorporated into mainstream macroeconomics or financial regulation during his lifetime, his prescient ideas about the boom-and-bust cycle

debt creation also increases the money supply and stimulates economic activity, this also tends to temporarily raise economic growth and employment.[34]

One of the most significant asset bubbles in US history was the stock market bubble preceding the Great Depression.[35] The early 20th century in the United States was a time of great expansion in participation in the public stock market, particularly the New York Stock Exchange (NYSE). Originally a closed community of stockbrokers with a narrow range of listed stocks, in the 1920s, stock trading aggressively expanded. The influx of new capital from the American public drove stock returns higher; at its height, the expected return on the stock market was much higher than the interest rate on loans. This, coupled with dubious stock sale practices and little regulation requiring investor disclosures, incentivised investors to take out high levels of debt to buy positions in the market, expecting to exit the position at a value high enough to pay back the debt and also profit. As interest rates began to rise, the stock market bubble burst, leading to the Great Depression and the collapse of the US economy.[36]

The most significant speculative asset bubbles in recent history was the real estate asset bubble that formed in the housing market at the turn of the millennium and culminated in the Great Recession of 2008. This real estate asset bubble was fuelled by the increase of subprime mortgage issuances financing new homes and the related phenomenon of housing speculation.[37] In response to growing investor demand for relatively safe high-yield investment during a time of low US Treasury bond yields, Wall Street investment banks developed new financial instruments from mortgages—most notably MBSs and CDOs—designed to secure high safety ratings from credit ratings agencies while still resulting in attractive yields. This was achieved via structured finance: the practice of slicing pools of mortgages into "tranches" with different priority in the principal and interest streams; top tranches earned higher ratings than the underlying mortgages otherwise would, allowing investment banks to sell these products to money markets and pension funds that would not otherwise enter the subprime mortgage securities market.[38]Attracted by their high ratings and returns, investors fuelled demand for MBS and CDOs. By 2003, the supply of mortgages originated under traditional lending standards was exhausted. To meet continued investor demand for mortgage-based financial

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of finance enjoyed a resurgence of popularity after the 2008 financial crisis. See John Cassidy, "The Minsky Moment" *New Yorker* (New York, 28 January 2008).

34 George Cooper, *The Origin of Financial Crises* (New York: Harriman House 2008).

35 The stock market crash of 1929 and the resulting Great Depression remains one of the enduring examples of the importance of regulating exchanges. See Kristin Johnson, "Decentralized Finance: Regulating Cryptocurrency Exchanges" (2021) 62 *William & Mary Law Review* 1911.

36 John Brooks, *Once in Golconda: A True Drama of Wall Street 1920–1938* (New York: John Wiley & Sons, 1999).

37 Mark Williams, *Uncontrolled Risk* (New York: McGraw-Hill Education, 2010); The Financial Crisis Inquiry Commission, The Financial Crisis Inquiry Report (January 2011), available at https://www.govinfo.gov/content/pkg/GPO-FCIC/pdf/GPO-FCIC.pdf (visited 29 May 2021).

38 Michael Spence, "Lessons from the Crisis" *PIMCO Viewpoints* (November 2008), available at http://media.pimco-global.com/pdfs/pdf/Lessons%20from%20the%20Crisis.pdf (visited 29 May 2021).

products, mortgage qualifications for home owners got lower and lower.[39] For instance, the standard qualification for a mortgage requiring proof of income was replaced with "stated income, verified assets", loans that required lenders simply to state their income without need of proof.[40] These were then replaced with "no income, verified assets" or "ninja" loans which required no proof of any income or assets but only a credit score.[41] The proliferation of secondary-market MBS products and the growing demand for such products from investors exacerbated underlying moral hazard problems that accompanied weakening mortgage-lending standards. Issuing banks that were in the best position to judge an applicant's creditworthiness no longer cared about whether mortgages could be paid off, since once these mortgages were issued they were no longer on their balance sheets. As the subprime mortgage bubble burst and related securities markets began to contract, major financial institutions experienced liquidity crises, which began to spill over into other parts of the economy.

(ii) Systemic risk

Asset bubbles are nothing new, but the 2008 financial crisis inspired greater attention from economists and regulators to the nature of *systemic risk* in the economy and its role in amplifying the effects of asset bubbles.[42] The term "systemic risk" has several inconsistent meanings. For the purposes of this article, we will use the definition of Schwarcz[43]: The risk that (1) an economic shock, such as market or institutional failure triggers (through a panic or otherwise) either (X) the failure of a chain of markets or institutions or (Y) a chain of significant losses to financial institutions, (2) resulting in increases in the cost of capital or decreases in its availability, often evidenced by substantial financial-market price volatility.

Anabtawi and Schwarcz[44] built on this definition to argue that systemic risk is the result of two otherwise independent correlations. "The first [is] intra-firm correlation between a firm's financial integrity and its exposure to the risk of

39 For an excellent and accessible overview of this process see "The Giant Pool of Money" *This American Life* (9 May 2008), available at https://www.thisamericanlife.org/355/the-giant-pool-of-money (visited 29 May 2021).

40 These loans were originated by AmeriQuest, one of the largest subprime lenders in the US market until it was dissolved in September of 2007. Paul Muolo and Mathew Padilla, *Chain of Blame: How Wall Street Caused the Mortgage and Credit Crisis* (Hoboken NJ: John Wiley & Sons, 2008).

41 Julia Kagan, "NINJA Loan" *Investopedia.com* (1 December 2020), available at https://www.investopedia.com/terms/n/ninja-loan.asp (30 August 2021).

42 Johnson, "Things Fall Apart: Regulating the Credit Default Swap Commons" (n. 28), 190 ("While there are many types of risk that accompany financial market activities, systemic risk poses a uniquely onerous threat. . . . The potential threat of a 'true systemic breakdown, collapsing the world's financial systems like a row of dominoes' evokes fears of national and international economic recession, or worse, depression. Scholars argue that the risk that paralyzed credit and capital markets during the recent crisis exemplifies a market failure triggered by systemic risk").

43 Steven L Schwarcz, "Systemic Risk" (2008) 97:1 *Georgetown Law Journal* 193.

44 Iman Anabtawi and Steven L Schwarcz, "Regulating Systemic Risk: Towards an Analytical Framework" (2011) 86:4 *Notre Dame Law Review* 1349.

low-probability adverse events that either constitute or could lead to economic shocks. The second is an inter-institutional correlation among financial firms and markets (collectively, institutions)". These correlations can combine to transmit localised economic shocks into broader systemic crises. While firms will manage their own risk through corporate money management, they will generally not manage the correlated risks that result from their transactions. These correlated risks are an externality. Hence, systemic risk accrues as a form of market failure. But systemic risk is also endogenous to firm behaviour. Brunnermeier *et al*. (2009) note the following regarding the role of systemic risk in the 2008 Recession:[45]

> "It is perhaps banal by now to point out that the reason why we try to prevent banking crises is that the costs to society are invariably enormous and exceed the private cost to individual financial institutions. Among other reasons, we regulate market risks to ensure that market participants internalize the negative externalities created by their operation in markets. The main tool which regulators use to do so, is capital adequacy requirements, but the current approach has been found wanting. It implicitly assumes that we can make the financial system as a whole safe by ensuring that individual banks are safe. This sounds like a truism, but in practice it represents a fallacy of composition. In trying to make themselves safer, banks, and other highly leveraged financial intermediaries, can behave in a way that collectively undermines the system."

In short, selling an asset when its perceived risk increases may be prudent from the point of view of any individual institution, but if many banks sell such assets simultaneously, the asset price will collapse. Such responses not only lead to generalised declines in asset prices but also lead to enhanced correlations and volatility in asset markets.[46] Risk is thus endogenous to institutional behaviour. As institutional behaviour increasingly responds to correlated signals such as current market price ("often in the name of sophistication, transparency, and modernity"), this endogeneity of risk to institutional behaviour is intensified. Simply put, the more firms are responding to the same signal, the greater the risk of a positive-feedback loop being triggered and the greater scope such a positive-feedback loop will have.[47] Both

45 Markus Brunnemeier, Andrew Crockett, Charles Goodhart, Avinash D Persaud and Hyung Song Shin, "The Fundamental Principles of Financial Regulation" *Geneva Reports on the World Economy 11* (June 2009) xvii, available at https://cepr.org/sites/default/files/geneva_reports/GenevaP197.pdf (visited 29 May 2021).

46 *Ibid*., xvii.

47 The use of the term "positive feedback" to describe a *downward* spiral in prices may not be intuitive. Positive feedback describes any process where a small change prompts a feedback loop that iteratively amplifies the change, that is "A produces more of B which in turn produces more of A". Positive-feedback loops are observed throughout nature. For their observation in economic contexts, see Paul V Azzopardi, *Behavioural Technical Analysis: An Introduction to Behavioural Finance and its Role in Technical Analysis* (Petersfield Great Britain: Harriman House Limited, 2010) p. 116.

the Great Depression and the 2008 financial crisis illustrate how asset bubbles can interact with correlated risk in the economy to trigger a financial crisis. Brunnermeier *et al*. (2020) study the relationship between asset bubbles and systemic risk.[48] They note that not all asset bubbles have the same macroeconomic impacts. "Some, like the one preceding the Great Financial Crisis, contribute to the collapse of the entire financial system, while others, like the dotcom bubble, cause high financial losses without any wider macroeconomic consequences". However, all asset bubbles contribute some risk, and this systemic risk exists in the build-up phase of the bubble, not just in the moment the bubble bursts. Financial crises due to systemic risk are some of the more dramatic risks facing investors.

(iii) Systematic risk

A more general way of looking at market risk is through the lens of *systematic risk*, or risks that cannot be reduced by diversifying a portfolio. These risks affect all market actors, from households to firms, and are traded off against expected returns. We have discussed how asset bubbles can form when there is easy credit and poor information about fundamental asset value. Asset bubbles in a system with a great amount of systemic risk can trigger either a financial crisis or a market-wide credit crunch. Financial crises and crunches due to systemic risk are, along with inflation, wars and pandemic diseases, one of the major causes of what investors call *systematic risk*. Systematic risk is volatility in a market or market segment, as opposed to in the price of a particular asset. Systematic risk is relevant to investors because this risk cannot be mitigated by diversifying one's asset portfolio. Generally, investors seek to maximise returns and minimise risk, picking a position on the "efficient frontier" that trades off between these two goals.[49] Investors, including individuals with a pension fund or retirement account, are worse off the greater the systematic risk. In this very general sense, macroprudential policies that reduce the occurrence of asset bubbles and correlation between firm losses serve the interests of the general public by improving the ratio of the expected return to risk on savings.

C. Regulatory response

Both the stock market crash of 1929 and the subprime mortgage crisis of 2008 resulted in widespread economic downturn and prompted significant regulatory responses aimed at curbing future bubbles and mitigating their harmful effects. These regulatory responses are illustrative of how financial risk (and its effects on ordinary households) can be managed via regulation and provide lessons (explored further in Section IV) for regulatory responses to data market risk.

48 Markus Brunnermeier, Simon Rother and Isabel Schnabel, "Asset Price Bubbles and Systemic Risk" (2020) 33:9 *The Review of Financial Studies* 4272.

49 Harry Markowitz, "Portfolio Selection" (1952) 7:1 *The Journal of Finance* 77.

(i) The Great Depression

Following the Great Depression, and amidst the general creation of the modern administrative state, securities markets came under federal regulation by two of the most enduringly significant forms of regulation. The Securities Act of 1933 (the 1933 Act) mandated the disclosure of significant financial information about securities made available for public sale and prohibited fraud or deceit in this information. A company registering under the 1933 Act must create a registration statement along with a prospectus, extensive information about the securities being sold, the company, their business and audited financial statements. The company, the underwriting bank and other individuals signing the registration are all strictly liable for any inaccuracies in a company's registration. In short, this Act regulates the primary market in which original securities are issued.

The Securities Exchange Act of 1934 (the 1934 Act) is a wide-ranging regulation that governs the secondary trading of US securities (stocks, bonds and debentures). It established the Securities and Exchange Commission (SEC), the agency tasked with the enforcement of US securities law. It extended the initial disclosure requirements of the 1933 Act to securities traded in the secondary market, requiring companies to regularly file company information via 10-K filings, 10-Q filings and 8-K filings in the event of a material change. Section 10(b) of the 1934 Act (along with its corresponding SEC Rule 10b-5) provide a private right of action for stock purchasers and impose significant anti-fraud protections against insider trading, price fixing, fraudulent stock sales and failure to communicate material information to investors.

The 1934 Act (and a 1938 amendment) also established the basis for the registration and self-regulation of exchanges as self-regulatory organisations (SROs). As of 2007, two of the most prominent SROs, National Association of Securities Dealers and the NYSE merged and became the Financial Industry Regulatory Authority (FINRA). FINRA is now the primary entity that regulates the behaviour of exchanges. In line with other prohibitions against insider trading, FINRA's self-regulations now also prevent exchanges from engaging in practices where there is a clear conflict of interest, such as operating a trading arm that uses information from buyers and sellers.[50] Both the 1933 Act and the 1934 Act were a response to the forms of market dysfunction that contributed to the Great Depression. In particular, due to a lack of clear and reliable information about companies, investors were largely in the dark about the true value of stocks. This led to more *chartist* trading strategies, which depended mainly on the changing market price of stocks, rather than *fundamentalist* trading strategies based on realistic analysis of the underlying companies. As a result, one of the primary purposes animating both

50 See the Insider Trading Prohibition Action (2019), for an attempt to turn this into a federal statute. Wilmerhale, "Insider Trading Prohibition Act Passed by the House of Representatives" *WilmerHale* (19 December 2019), available at https://www.wilmerhale.com/en/insights/client-alerts/20191212-insider-trading-prohibition-act-passed-by-the-house-of-representatives (visited 14 December 2020).

Acts is to ensure that buyers of securities receive complete and accurate information before they invest. The 1933 Act embraces a disclosure principle—it is not illegal to sell a bad investment, but it is illegal not to disclose all relevant facts before doing so. Similarly, much of the 1934 Act's ongoing obligations and enforcement focus concerns disclosures and ensuring that they are timely, accurate and fair. The going concern of both forms of regulation are to ensure that the investors have a sound basis for analysing stock value based on fundamentals, reducing market volatility and thus helping to ensure that investment tracks with—and rewards—good performance.

(ii) Subprime mortgage crisis

The 2008 crisis resulted in both national and international regulatory responses that are still unfolding today. In the United States, the predominant regulatory response to the subprime mortgage crisis was the Dodd–Frank Wall Street Reform and Consumer Protection Act.[51] Title I of the Act provided a series of measures to measure and manage systemic risk. It created the Financial Stability Oversight Council (FSOC) and the Office of Financial Research (OFR) in the US Treasury Department (two agencies designed to work closely together to monitor systemic risk and research the state of the economy).[52] It also introduces heightened monitoring and regulatory authority over systemically important financial institutions (SIFIs); the FSOC may require any bank or non-bank financial institution with assets over $50 billion to submit certified financial reports, and (with a two-thirds vote) may place non-bank financial companies or domestic subsidiaries of international banks under the supervision of the Federal Reserve if it appears that these companies could pose a threat to the financial stability of the United States.[53] Under supervision, companies may be required to comply with more stringent capital adequacy requirements, to undergo stress testing and to develop plans for rapid and orderly liquidation in the event of failure.[54] In addition to the direct additional regulatory scrutiny such firms face, the spectre of such additional regulation may have also reduced the attractiveness for financial institutions of becoming too large.[55] The

51 12 USC 1851.124 Stat. 1376–2223. Dodd–Frank provided many provisions beyond those described here and was significantly cut back during the Trump administration.

52 US Treasury Department, "Financial Stability Oversight Council", available at https://home.treasury.gov/policy-issues/financial-markets-financial-institutions-and-fiscal-service/fsoc (visited 29 May 2021); OFR, available at https://www.financialresearch.gov/ (visited 29 May 2021).

53 12 USC 1851.124 Stat. 1376–2223, Title I Subtitle A, s.111 establishes FSOC; Subtitle B, s.152 establishes OFR; Subtitle A, s.112 and Subtitle C, s.165 establish heightened monitoring authority and requirements.

54 12 USC 1851.124 Stat. 1376–2223, Title I Subtitle A, Subtitle C, s.165(c). Title II establishes the Orderly Liquidation Authority to oversee the liquidation of financial institutions to minimise the systemic effects of failure.

55 Paul Krugman, "Half A Loaf, Financial Reform Edition" *The New York Times* (New York, 3 February 2016) ("Should we have had a stiffer financial reform? Definitely—required capital ratios should be a lot higher than they are. But Dodd–Frank's rules—especially, I think, the prospect of being classed

Act included the Volcker Rule (s.619 of the Act) to limit speculative investment by financial institutions by reducing proprietary trading and thus reducing the moral hazard introduced by such activity. It also had provisions to limit over-the-counter trading of derivatives, requiring many derivatives to be cleared through exchanges and therefore increasing transparency.[56] Finally, while not implemented in the bill stage, the Act proposed separation of higher-risk investment banking from depository banking, thus insulating the consumer banking system from higher risk commercial investment activities.[57] Internationally, members of the Basel Committee on Banking Supervision approved a new regulatory framework, Basel III, to better address systemic risk through new standards for bank capital adequacy, stress testing and market liquidity risk.[58] Under Basel III, capital requirements have gone up from 2 per cent (under Basel II) to 4.5 per cent; leverage ratios (Tier 1 Capital/Total exposure) must remain greater than 3 per cent, and greater than 6 per cent for SIFIs, and the new Liquidity Coverage Ratio requires banks to hold enough high-quality liquid assets to cover net cash outflows for 30 days.[59]

In the following section, we will explore the relationship between data markets and financial risk. We will use concepts introduced in this section. We regard systemic risk as a property of the economy that is conditioned by correlations between the financial risks faced by institutions and also households. We consider systematic risk in a broad sense beyond capital allocation to the unmitigable risk posed to any firm or household as they interact with multiple sectors of economic activity. In many cases, these are two different ways of looking at the same financial risks.

IV. Regulating the financial risk of data markets

In Section II, we explored how the market for personal data is connected with the financial system and its risks, and how it, in many ways, shares the pathologies of capital flows. Personal data are used in credit and insurance markets to calibrate the risk and prices of loans and policies. They are used in advertising markets to distinguish ad space opportunities, determine the effectiveness of ads and also sometimes for price discrimination of goods sold digitally. Personal data are therefore used

as a SIFI, a strategically important institution subject to tighter constraints, have had a real effect in reducing risk").

56 12 USC 1851.124 Stat. 1376–2223, Title VII, Subtitle A. Title VII is also referred to as the Wall Street Transparency and Accountability Act. N Eric Weiss, "The Dodd-Frank Wall Street Reform and Consumer Protection Act: Background and Summary" (2018) R41350 *Congressional Research Service Reports* 23.

57 The Glass-Steagall Act (Pub.L. 73–66, 48 Stat. 162, enacted 16 June 1933) did in fact separate these activities but was repealed in 1999 by the Financial Service Modernization Act or the Gramm-Leach Bliley Act.

58 While agreed upon in 2010, Basel III standards implementation has been met with repeated extensions and is currently set to go into effect in January 2022. Financial Stability Board, "Basel III—Implementation" (2020), available at https://www.fsb.org/work-of-the-fsb/implementation-monitoring/monitoring-of-priority-areas/basel-iii/ (visited 21 March 2020).

59 The Fed's proposed Liquidity Coverage Ratio is actually more stringent. See Jesse Hamilton, "Fed Liquidity Proposal Seen Trading Safety for Costlier Credit" *Bloomberg* (24 October 2013).

mainly in strategy and evaluation in secondary markets for securitised consumer activity and property.

In Section III, we outlined how financial regulation has evolved to reduce systemic and systematic risks associated with asset bubbles and financial crises. This goal animates financial regulation in concert with complementary regulatory regimes to minimise market failures, ensures that the outputs of the market are adequately redistributed, guards against too much market concentration in financial services, smooths and stabilises volatile markets and protects the needs of ordinary people in the financial economy. Regulations achieve these goals by addressing the relational and opaque properties of capital flow. The opacity of capital flows contributes to uncertainty about underlying asset quality, which can lead to market failures and speculative asset bubbles. The relational nature of capital flows links together financial outcomes, creating systemic and systematic risks.

Put simply, many of the social harms of relevant legal concern to data governance and privacy law may be characterised as analogous to those of unregulated financial markets: companies (in this instance, digital technology companies that process large quantities of consumer data) are driving up the speculative value of what data about people can deliver in the form of realised *financial* returns for clients and investors. This is most evident in the digital advertising context but may hold for inflated claims in other tech-inflected industries as well.

A. Data and correlated risk

This article posits a connection between the business-to-business transactions of personal data (or personal-data-driven services) and market risk.[60] Personal data are purportedly useful information about a set of referents, the data subjects. To the extent that it is used to profile individuals and price securitisations of their behaviour through targeted advertising or credit scoring, the data have an uncertain monetary value. Data that are harvested from consumers flow through a "programmatic supply chain"[61] between institutions. As it does so, it creates correlations between the activities of the firms and the data subjects. Indeed, a data flow can be thought of precisely as a relationship between entities that allows their behaviour to be correlated in some way.[62]

We identify four different categories of market correlation that are in principle enabled by personal data transactions. We distinguish between risks facing consumer households and risks facing business institutions. Both kinds of economic

60 We define personal data transactions rather broadly to include those data transfers or business-to-business services that depend substantively on the information in the data, even if the data are not transferred. Hence, we include transfers of anonymised data and transactions that are based on profiles built and ascribed based on user data. We also include access to data-for-free service contracts.

61 *ISBA Programmatic Supply Chain Transparency Study* (2020), available at https://www.isba.org.uk/knowledge/digital-media/programmatic-supply-chain-transparency-study/ (visited 29 May 2021).

62 Note this could be a positive or negative correlation. Sebastian Benthall, "Situated Information Flow Theory" (2019) *Proceedings of the 6th Annual Symposium on Hot Topics in the Science of Security* 1.

actors are exposed to financial risks, whether be it idiosyncratic shocks to income or fluctuations in profits and loss. We also distinguish between horizontal correlation between actors similarly positioned with respect to a market (such as consumers in general, or advertisers in general) and vertical correlation between actors connected by a transaction (such as a correlation between a consumer and a producer mediated by an advertising exchange).

When consumers are included in the same profile, they will be treated similarly by advertisers, credit score agencies and other downstream users of their personal data. This entails correlated outcomes with respect to domains such as employment, access to credit, insurance policies and financed household purchases. We call this correlation across consumer finances *horizontal consumer correlation*. This correlated circumstance is *systemic*, involving a contagion across individuals and firms. It is also an externality to each consumer-service transaction. It is also opaque to the consumers, who are not in a position to understand how they have been profiled or with whom.

We identify as *vertical consumer correlation* the situation in which multiple firms acting on the same shared data about a consumer will act towards that consumer in correlated ways. When the consumer has the option to deal with a variety of differently informed firms, it is possible for the consumer to mitigate his or her risk by diversifying his or her transactions across many service providers. When all firms with which they interact have access to the same personal data, the consequences of that data flow cannot be avoided by diversification. Hence this correlation increases the *systematic risk* of the consumer with respect to its interaction with services. In addition to creating systemic and systematic risks that may reduce risk-adjusted returns for investors, both horizontal and vertical consumer correlations can contribute to systemic inequalities by reinforcing outcomes based on biased training data.[63]

Business profits and losses are also potentially correlated by flows of personal data. While in practice, savvy businesses are constantly evaluating the usefulness of their third-party data sources, an abrupt change in data quality can cause a shock to business performance. This is not unlike how a supply chain shock can disrupt businesses in the real economy. By *horizontal business correlation*, we refer to ways that businesses that act on the same aggregate personal data set will do so in a way that is correlated, especially with respect to shocks in data quality. If the data suddenly lowers in quality, then the businesses will all incur losses simultaneously. This is a potential source of contagious loss. By *vertical business correlation*, we refer to how a chain of firms providing services to each other in a way that is substantively informed by an aggregate personal data set will have correlated

63 Ben Green and Lily Hu, "The Myth in the Methodology: Towards a Recontextualization of Fairness in Machine Learning" (2018) *Proceedings of the Machine Learning: The Debates workshop at the 35th International Conference on Machine Learning*.

behaviour and, possibly, performance. A sudden loss in data quality may cause all downstream firms to engage in behaviour that causes them losses.[64]

These forms of correlation are subtler than the correlations between firms due to balance sheet relationships and financial integrity. However, they are still systemic influences on the economy that create more systematic risk. Just as the Great Recession, the result of an asset bubble and systemic risk, led to greater market volatility, so too (we posit) the economy of personal data creates inter-consumer and inter-business correlations that contribute to systematic risk.

B. The special challenges of the financial risks of personal data

We have argued that personal data markets should be understood as a recently formed, additional component of the financial system. Because of the relationships between personal data markets, credit markets and stock markets, as well as the way personal data inform business decisions, personal data markets create correlated market risks and hence systemic and systematic risks. These risks connect both firms and consumer households, both of which are earning, spending, borrowing and investing in the economy. We propose that understanding these connections provides a new way of understanding privacy and data protection: as a way of mitigating financial risk.

This proposal raises many research questions clarifying how and under what conditions personal data markets contribute to systemic and systematic risks. Despite its many connections to the financial system, personal data are in many ways unlike either credit or capital. Foremost among these differences is the "public goods character" of data, such that it may be reproduced in a low cost, non-rivalrous way. While this quality of data has anchored many arguments about the need for intellectual property protections and innovative "bundling" business models,[65] it also belies the ways data storage, transport and processing costs mount as personal data are aggregated into "big data". It can still be said safely that personal data flows are subject to rather extreme economies of scale and that they are not necessarily scarce due to legally constituted excludable property rights. This aspect of data makes it potentially *more* active in correlating market activity than capital flows.

Another difficulty posed by the personal data market is its natural opacity. While it has been argued that this opacity is due to the closedness of software

64 Both horizontal and vertical business correlation are exacerbated by the considerable concentration of firms in the digital economy, not only legally (as mergers drive firm concentration) but also technically (as large technology companies are technically integrated into the source code of many online and mobile applications). See Tobias Blanke and Jennifer Pybus, "The Material Conditions of Platforms: Monopolization Through Decentralization" (2020) 6:4 *Social Media and Society*.

65 Carl Shapiro and Hal R Varian, *Information Rules: A Strategic Guide to the Network Economy* (Cambridge, MA: Harvard Business Press, 1998).

systems or "algorithms",[66] we locate the opacity of the personal data market rather in how a data transaction implies an information asymmetry between, *ex ante*, the buyer and the seller, and *ex post*, the two parties of the transaction and everyone else. This aspect of data makes it *less* accountable than other forms of capital flow as a source of risk. These complications have made the economy for personal data intractable to regulators thus far. This has enabled powerful actors to amass opauqe forms of concentrated market power, and frustrated consumer advocates who observe the trampling and erosion of privacy rights.

Last, while we have argued that the consequences of personal data flows can be understood in terms of financial risk for consumers and firms, personal data are consequential for individuals in many ways that go beyond the financial sector. For example, personal data flows may be salient to an individual's health, psychological well-being, autonomy and dignity. The preceding scholarly discourse around consumer privacy has mostly addressed how personal data are implicated in these personal and societal interests beyond financial or economic concerns. Regulations aimed at the financial risks of personal information flows must be calibrated so as not to violate these other legitimate social goals.

C. Adapting capital markets regulation to data markets

Regulators have addressed information asymmetry in capital markets through a slate of regulatory tools. These include means of compelling disclosure to both regulatory authorities and investors, as well as trading rules to mitigate the effects of principal–agent problems (by shifting risk back onto the party with greater information). Required disclosures that are accessible and readily usable are "central to the SEC's mission of protecting investors, maintaining fair, orderly, and efficient markets, and facilitating capital formation".[67] Trading rules are "derived from a simple and straightforward concept: all investors, whether large institutions or private individuals, should have access to certain basic facts about an investment prior to buying it, and so long as they hold it".[68]

Transparency and disclosure requirements are the keys to tracking capital flows and understanding the overall picture of our capital economy: how the economy is growing, where investments are going and to what uses they are being put and how interrelated our financial economy is with that of other countries. With this information at hand, regulators and the public may evaluate our current financial economy to impose market discipline where needed and design regulatory

66 Jenna Burrell, "How the Machine 'Thinks': Understanding Opacity in Machine Learning Algorithms" (2016) 3:1 *Big Data & Society*. For a broader discussion of the opacity of technology companies, see Frank Pasquale, *The Black Box Society* (Cambridge, MA: Harvard University Press, 2015).

67 US SEC, "Structured Disclosure at the SEC: History and Rulemaking", available at https://www.sec.gov/page/osdhistoryandrulemaking (visited 29 May 2021).

68 US SEC, "What We Do", available at https://www.sec.gov/about/what-we-do (visited 18 December 2020).

interventions for the problems market discipline may not reach. The same might be true for the "informational investment" that our collective flows of data represent. With adequate measures, we might be able to assess from a collective view where information flows are going, to what ends it is being put, assess what this tells us and determine whether current informational flows align with our societal priorities and concerns. This kind of understanding is considered core to any systematic study or analysis of the financial economy and, we argue, would be highly beneficial for any attempt to regulate informational flows at scale for social benefit.

This transparency also benefits investors directly by reducing their exposure to risk. Uncertainty about stock quality was a major contributor to the Great Depression. Uncertainty about credit quality was a major contributor to the 2008 financial crisis. Regulatory responses to improve asset quality knowledge do so by placing the disclosure requirements on the systemically significant issuers of the security: banks and publicly traded companies. Disclosures, held veridical by the pain of C-suite liability, anchor assessments of value within the market on fundamentals and level the playing field for market entrants who would otherwise be unfairly pitted against insiders. These regulations ultimately expand the capital pool available in these securities markets.

Advertising markets have only recently reached the level of sophistication we have come to expect from capital markets. Though we can expect advertising markets to share the systemic pathologies of capital markets, they are not regulated with these risks in mind. A logical next step would be to introduce "advertising market discipline", modelled on regulations that improve financial market discipline. For example, regulations could insist that systemically significant issuers of the behavioural security, which in this case are the major publishers on the supply side of the advertising market—including Google search, Facebook's social media properties and so on—disclose the information about the "fundamentals" of the ad spaces being sold. These disclosures would include information about the sources of profiled personal data, including the first-party sources (eg social media of the platform, queries); second-party sources, such as data collected through cookies; and third-party sources, such as those data that were purchased from data brokers. The disclosures would also include the activity or engagement rates used by the ad space supplier to evaluate the effectiveness of the advertisements (ie the "per click" or "per activity" measures), which are analogous to a dividend in the stock market and should be made public in order to ground pricing decisions about the assets. If these disclosures are valid on pain of C-suite liability, these measures would reduce click fraud and make the ad exchanges less volatile and more efficient. These measures would be complementary to structural separation of business functions with conflicted interests.[69]

69 Srinivasan, "Why Google Dominates Advertising Markets" (n. 21); Khan, "The Separation of Platforms and Commerce" (n. 23).

A perhaps bolder extension of this new regulatory strategy would be to develop rules that treated the *data* as a security. In sum, personal data intersect with financial and behavioural securities in multiple ways. It is used to assess credit scores and insurance rates, and it is used to annotate the offers of ad spaces on an exchange. The personal data are used to enhance the quality of these securities by reducing its risk. As we have argued above, disclosures about the sourcing of personal data would bring transparency to these secondary securities markets. At the level of stocks—securitised corporate property and earnings—the story is more complex. Personal data are seen as an asset of a company, in part because of how they can be monetised in service of other securities markets. Consequently, personal data stores would best be considered part of the fundamentals of a company that would be disclosed in a 10-K under securities law.

Because of the relational nature of data flows, data's meaning is only made clear by its provenance. Ultimately data get their value from how well they represent their referent, which is determined at the point when they are collected. Hence, disclosures about data sources are only meaningful if they apply recursively to any intermediary, such as a data broker or an Application Programming Interface (API) provider, who provides the data. Instrumentally to the goal of reducing the volatility of secondary securities markets (including credit, stock and behavioural securities), we would introduce a regime of data flow disclosure among all significant companies engaged in these networked sectors.

The preceding arguments suggest a conceptual shift. Because of their long analogue trading histories, we are not accustomed to associating credit and stock markets with the digital economy of the past 30-odd years. However, in fact, what has happened is that capital markets are increasingly electronic and enmeshed with a more expansively surveilled and instrumented digital ecosystem. Today, we can distinguish the *real economy* of property, assets, goods, services and earnings, from the financial, cyber or virtual economies, which are coextensive. In the cyber economy, the real economy is securitised and traded on the basis of probabilistic expectations of returns. Data are a first-order element of the cyber economy; it is what tethers financialised securities to the real economy. It is a by-product of securitisation itself. Data are an ingredient that is bundled with other financial instruments as the market articulates itself to participants and so should be understood as a security in its own right. By extension, major issuers of data (those that collect data in a systemically significant way) should be subject to disclosure rules like other major issuers of securities.

D. Macroprudential contextual integrity and distributive justice

Legal protection of privacy has largely been pursued under the banner of consumer protection. For reasons discussed in Section I, notice and choice frameworks aimed at empowering individuals to have more control over their personal data have not been effective at substantively addressing consumer privacy. Helen

Nissenbaum's theory of contextual integrity[70] provides an alternative account of privacy as appropriate information flow that disconnects it from the shaky foundation of consumer choice. According to contextual integrity, society is compartmentalised into distinct social spheres with their own informational norms about the appropriate flow of personal data. Contextual integrity provides normative support for sectoral privacy rules that protect personal information in health, finance, and education sectors. However, a noted weakness with contextual integrity theory is that it has little to say about inappropriate flows of personal information across and between social spheres.[71] These cross-context flows are largely what are at stake when considering data brokers and data collection on the consumer Internet. To address these cross-contextual data uses, we have focused on one societal value that animates existing regulation: the macroprudential value of reduced financial risk. The financial system pervades and connects households with many sectors of industry. Macroprudential considerations orient information flows around corporate accountability to a public regulator.

Privacy scholars may raise two concerns with this approach. One concern is that regulation that supports the interests of the financial system might erode other senses of privacy closer to the more conventional sense of consumer protection, because the financial system might be served best by harvesting *more* personal data. A second concern is that the societal value of macroeconomic stability might be in conflict with other societal values, such as social equality or distributional justice. Why would regulation that favours the interests of investors be expected to serve the interests of society more generally?

These are legitimate and serious concerns. However, we maintain that our proposed approach has many benefits especially when *complemented* by other data protection laws and privacy rules. Rather than trying to bolster the agency of the *suppliers* of data (the user, who is not in a position to understand the consequences of his or her data being collected), our proposals address the *demand* for personal data, which is located in a heterogeneous network of firms and markets. We believe that the impetus for inappropriate flows of personal information lies mainly on the demand side. There are many legitimate uses of personal data. What is concerning from a privacy perspective is the unaccountable, messy and opaque economy of personal data that are beyond the reach of regulation. Even within this economy, data provenance, and therefore quality, is uncertain. This uncertainty can lead to an *increased demand* for data from third-party sources, because new data sources and derivative assets, such as advertising opportunities, are of uncertain quality. This can lead to asset speculation, as when a new start-up gets investment for "growth hacking" to collect users and harvest data for unspecific and shifting purposes. In the fast-moving and frothy economy of such companies, data are of uncertain

70 Nissenbaum, *Privacy in Context: Technology, Policy, and the Integrity of Social Life* (n. 3).

71 Sebastian Benthall, Seda Gürses and Helen Nissenbaum, *Contextual Integrity through the Lens of Computer Science* (Boston, MA: Now Publishers, 2017).

provenance and quality. It can be necessary to complement it with redundant, differently sourced data in order to perform error correction. This results in more data getting collected, by more, unaccountable sources. Market discipline will reduce the number of junk firms and junk data harvesting and corral significant actors into a regulatory paradigm in which data flow appropriateness can be better assured.[72]

Imposing greater market discipline on the speculative demand for personal data also has important distributive implications. Inflated demand for personal data drives excessive data extraction that can expose individuals to all manners of surveillance-based harm, not only eroding individual privacy and control but also enacting and amplifying social inequality. This in turn, may render systemic advantage and disadvantage legible in ways that may not align with broader social ideals. By imposing discipline on the claims that underpin data collection's value and working to internalise the risk such activities generate, the cost of extractive data practices can be increased and excessive demand for such data reduced.

72 For an articulation of the view that a rapidly shifting economy of small, unaccountable firms is dangerous for consumer protection, see Frank Pasquale, "Tech Platforms and The Knowledge Problem" (2018) II:2 *American Affairs*, available at https://americanaffairsjournal.org/issue/summer-2018/ (visited 29 May 2021).