Platform Economics in the Second Machine Age

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In any economy, there are two interconnected layers. In the more physical or tangible one, goods are produced (using tangible capital and labor and other inputs like energy and natural capital), people are employed, goods moved around, and are bought and sold on markets, or used by companies to invest in the capital. The second layer, which is much less tangible, is where information and knowledge are generated and exchanged, relationships are built (coordination), and decisions are made. Hereafter we will call the information, coordination, and decision layer the ICD layer.

At a slight risk of overstatement, most of economic theory (meaning economic models) deals with the first layer. The second layer is there of course. Nothing works in the tangible layer without it, but it is largely unmodelled. There are important exceptions: there is an important body of economic theory dealing with various aspects of the ICD layer: innovation, search in several dimensions, informational asymmetries, with credible communication, and contracts, the role of intermediaries, the theory or organizations and the coordination of activity via non-market processes, and so forth. But in much basic economic theory, the ICD layer is implicit and taken for granted.

In the first industrial revolution, energy was harnessed to augment, and to some extent replace, human physical activity. The steam engine, electricity, and fossil fuels and machines powered by them, ushered in centuries of innovation and mechanization. Machine augmentation produced a sustained rise in the productivity of people and economies, enabling historically unprecedented growth in incomes, output, new products, and material well-being. The point of this paper is not to track this evolution, but simply to note that during this revolutionary period, the second ICD layer remained not only

firmly in the hands of people, but also largely untouched by machines and machine augmentation and automation.

Which brings us to the digital age in which we find ourselves now, a period almost entirely located in the decades since WWII. In this more recent period, digital machines were introduced for the first time to the ICD layer. What we are experiencing now is essentially the beginning of the mechanization and machine augmentation of the crucial information, coordination, and decision-making dimension of the economy. Since the key element of the ICD layer is information, it is useful to think of this as information machine augmentation. Just as in the first industrial revolution, machine augmentation drove productivity and growth, now information machines operating in the ICD layer will replace some human activity (because the machines are superior mechanically and getting much smarter than their earlier versions), but in the end mainly augment humans and drive productivity in that layer and derivatively in the tangible layer that it governs. Brynjolfsson and McAfee have labelled this stage of economic evolution as "The Second Machine Age" in their influential same-titled book. It is the age of information machine that transforms the ICD layer of the economy.

The key ingredients in the rise of machine augmentation in the ICD layer are not difficult to identify. First, information needs to be in digital form. Digitizing information starts slowly, because initially most information is in non-digital form, but then the process accelerates as the ICD layer shifts increasingly to digital. Second, machines in the ICD layer have to operate on digital information and be able to do at least some of their work autonomously. The programmable computer, that loads a digital instruction set called a program, and then executes it, enabled automation in the ICD layer. Just this innovation has caused a large and well documented decline in “routine” jobs or tasks in the ICD layer of the economy.

The third key ingredient, which bears most of the fruit of the digitization of the ICD layer, is a network that connects the people and machines. With an Internet based on standardized and universal protocols, and with the addition of mobile, we are

approaching near universal connectivity. In principle, then, every element (people, computers, servers and internet of things) on the network can interact with all the other elements, and with a vast and growing store house of digital information.

The growth of data-capable cell phone networks and the rise of the mobile internet (starting roughly 15 years ago) has dramatically expanded access to the new digital infrastructure in the ICD layer. In the relatively near future, the vast majority of people on the planet are projected to have high speed connectivity and access to the resources in the digital ICD layer.

What drives this transformation of connectivity and access is the unprecedented reduction of costs of producing and transferring information. Thanks to the pioneering work of information theory by Claude Shannon and Alan Turing, who, in the 1940s, encoded data into its "digital atoms," known as bits. Combined with the new semiconductor technology used to store and process large volumes of data, these ideas led to an explosion of information in digital form. Barriers to and costs of access to information in the pre-digital ICD layer were much higher, especially for people who did not live and work in close proximity to major urban hubs where the offline information networks largely resided. In the digital ICD layer, both distance and time/delays are essentially eliminated as factors affecting access, with the result that both the ICD layer and derivatively the tangible layer become more inclusive, a subject we will return to below.

This brings us to the main subject of this paper, platforms and the ecosystems that surround them. We aim to address why platforms are an important element of infrastructure and functionality in the ICD layer of the economy that is being digitized, how they operate and create value, how inclusive growth patterns are enabled on the demand and supply side by the platform economics, and what are some of the opportunities and challenges that need to be addressed in order fully to realize the potential benefits.

Platforms in the Digital Economy

Why are digital platforms important? We are used to thinking of an economy consisting of consumers and producers (firms), but marketplace is actually the key structure that holds these building blocks together. In the tangible economy, including the ICD layer, you need marketplaces: for goods and services, but also for communication and information exchange. Marketplaces (in the broad sense – perhaps exchanges would be a more accurate term) are solutions to search, information gathering and transacting activities. They basically solve coordination and decision-making problems. In the pre-digital era, they do it for the most part by bringing people together physically – in firms, other organizations or in structured physical marketplaces. From Bazaars to stock exchanges, trading activity is crucial, and people have to come together to do it, either physically or virtually.[1]

What the digital ICD layer needs is not physical proximity. But it does need organized marketplaces, exchanges, and coordination mechanisms. Early users of the WWW will recall that search engines were immediately understood to be crucial pieces of infrastructure, but the early versions didn't work very well. Results from queries tended to miss the target, produced a mass of undifferentiated responses, most of them irrelevant. This is equivalent to inefficient information exchange.

Digital platforms are a key part of the infrastructure of the digital economy. They are the version of digital marketplaces, exchanges or meeting places that bring order to various aspects of the digital ICD layer. As such they are critical elements in the expanding functionality, power and efficiency of the digital ICD part of the economy. Just as traditionally economies have always grown through marketplaces, key components of economies are being digitized by the pull of marketplaces, which are digital platforms.

We have come to think of platforms as firms, for the obvious reason that firms created them. But digital platforms are not best thought of as firms. Platforms are organized sets

[1] All economies except the most primitive ones involve specialization to achieve productivity gains. This was the fundamental insight of Adam Smith, the founder of modern economics. Specialization implies exchange and hence the need for organized market places.

of coordinated digital markets and exchanges. One can think of them as ecosystems. Platform firms then are the creators, architects and managers of these organized ecosystems.

There is another important feature of digital platforms. We know (even without very complete models) that informal networks connecting people are important features of any economy. They are part of the structure of the ICD layer, with or without digital foundations. These networks serve as information transmission mechanisms and "search engines" in the non-digital world. Information is transmitted, and because of trust relationships, information is also screened for credibility. These networks are not static, but rather evolve in parallel with interactions that people have in the normal course of business in the economy and society. But such informal networks usually require close proximity. The experience of the past 20 years has shown that various digital platforms are an efficient and powerful mechanism for creating and expanding networks. Some platforms, like LinkedIn have this as their primary purpose. Others like Alibaba create and coordinate supply networks as part of the value creation process.

Digital platforms are not the whole of the structure in the digital ICD layer. Many digital tools such as resource planning software systems on which all modern corporations run, are also important components of the digital ICD layer. But platforms are among the most important entities that turn the economic and social value creation potential of the digital ICD layer into reality. Those who doubt the impact of digital platforms in the digitization of the economy might try to image a world with a connected internet, but no useful search engines, no mobile payments or eCommerce systems, or online credit sectors and asset management, no digital banking and insurance sectors, no gig economy or social media, no Airbnb and related travel sites, no maps and location specific services, and no cloud computing, or zoom or other platforms for meetings, communication and work collaboration. Though some of these services can be provided online by individual firms, they are most efficiently delivered, with unprecedented scope and variety, through platforms.

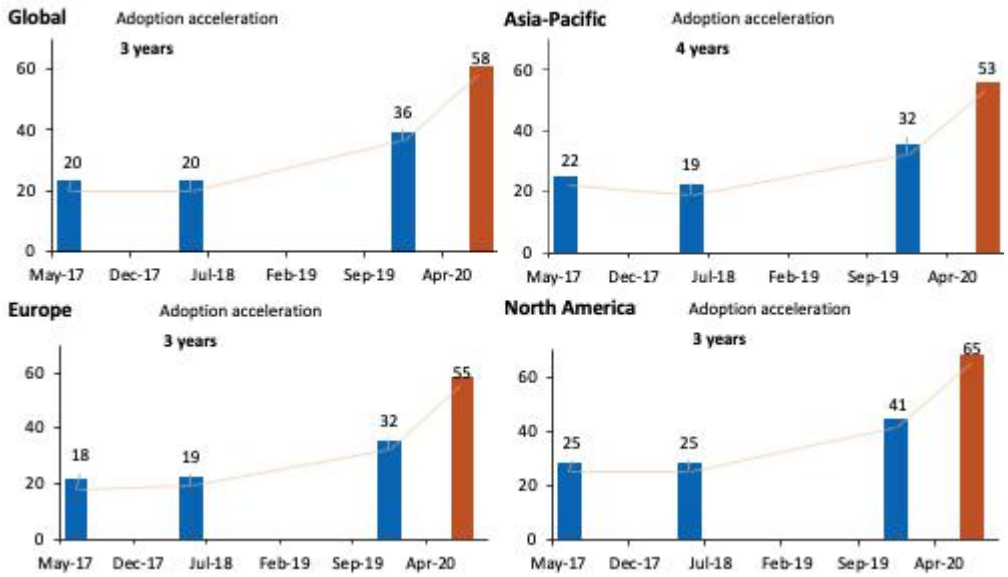
In the remainder of this essay, we turn now to an exploration of various dimensions of the platform economy, and on its impacts and some challenges.

Resilience and the Platform Economy

The pandemic economy taught us many lessons about our collective interests and vulnerabilities. The most obvious one is that there are shocks that make proximity dangerous. In the past, there was no practical way to reduce people to people contact without strangling the economy. Yet in this pandemic, large and crucial parts of the economy, especially in the ICD layer, kept on functioning. Ecommerce and finance are obvious examples, but so also education, home office communication, and some aspects of health care. All of these experienced a distinct acceleration in the digital economy, for the obvious reason that the pandemic eliminated non-digital alternatives.

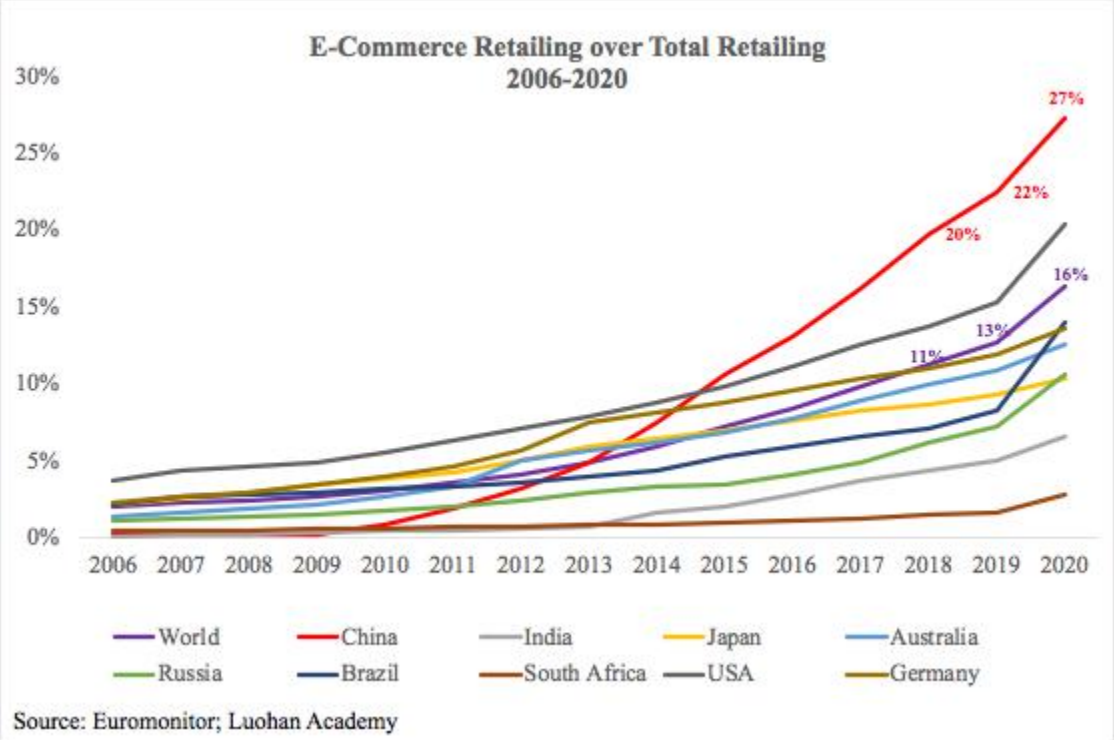
As shown in Figure 1, according to McKinsey's survey, global online consumer adoption rate has jumped dramatically from 36% in 2019 to 58% by July 2020. The jump is similar across regions: Asian-Pacific (21% increase), Europe (23% increase) and North America (24% increase).

Figure 1: Online consumer adoption rates



A similar pattern can be found if we measure online consumption amount as a percentage of total retailing (Figure 2). This global percentage has climbed with a steeper slope than before from 13% in 2019 to 16% in 2020. China leads the pack increasing from 22% to 27%. Similar patterns can be found in USA, Brazil, India, and Russia. It is noteworthy that, except for China, which already has a head start in ecommerce, countries that show faster growth of online consumption tend to be the ones more inflicted by Covid-19.

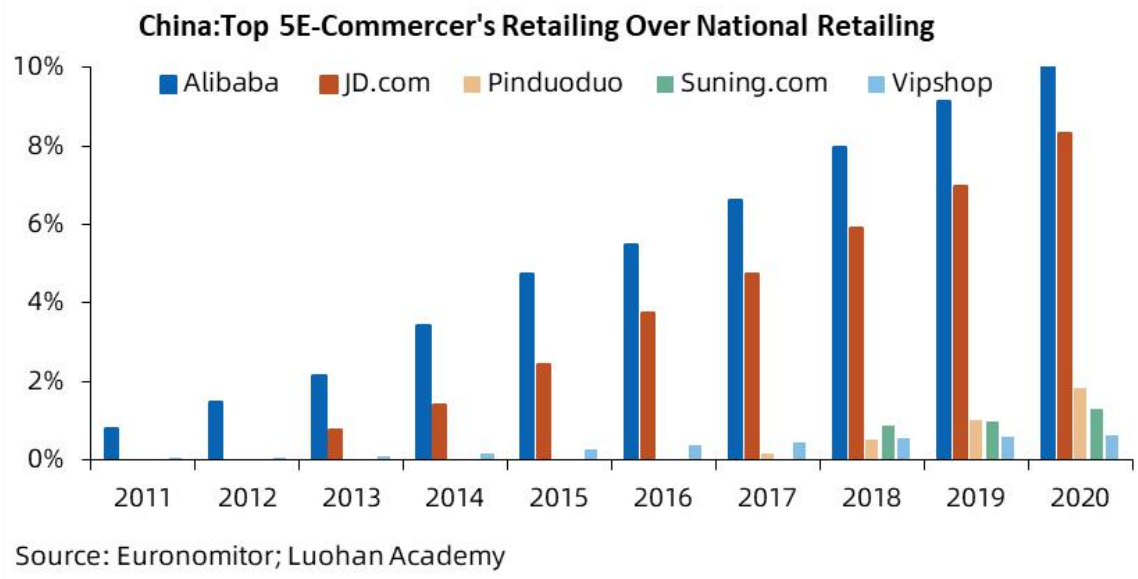
Figure 2: E-commerce retailing as a percentage of total retailing



This accelerated adoption of digital was enabled and organized by a variety of digital platforms. Take China as an example. As shown in Figure 3, the percentage share of top five ecommerce platforms has increased from 0.82% in 2011 to 23.44% in 2020. While Alibaba leads the way, other ecommerce players such as JD.com and Pinduoduo grew even faster. In just four years, Pinduoduo's users have grown from zero to surpassing JD.com and are now on par with Alibaba. So, it is through the digital platforms and their

dynamic competitions that China's ecommerce has accelerated, propelling tens of millions of retailers to serve more than one billion consumers.

Figure 3: The retailing share of China's top five ecommerce platforms



We see similar performance from platforms in other countries. While Amazon's cloud service sales remain steady in 2020 (red line in Figure 4), its ecommerce growth rate more than doubled (blue line in Figure 4). Zoom's monthly active users (MAU) grew from 10 million by the end of 2019 to more than 200 million in 2020 (Figure 5). The number jumped by more than 1000% in Indonesia, Russia, India, Mexico, UK, and Japan.

Figure 4: Amazon's performance during Covid-19.

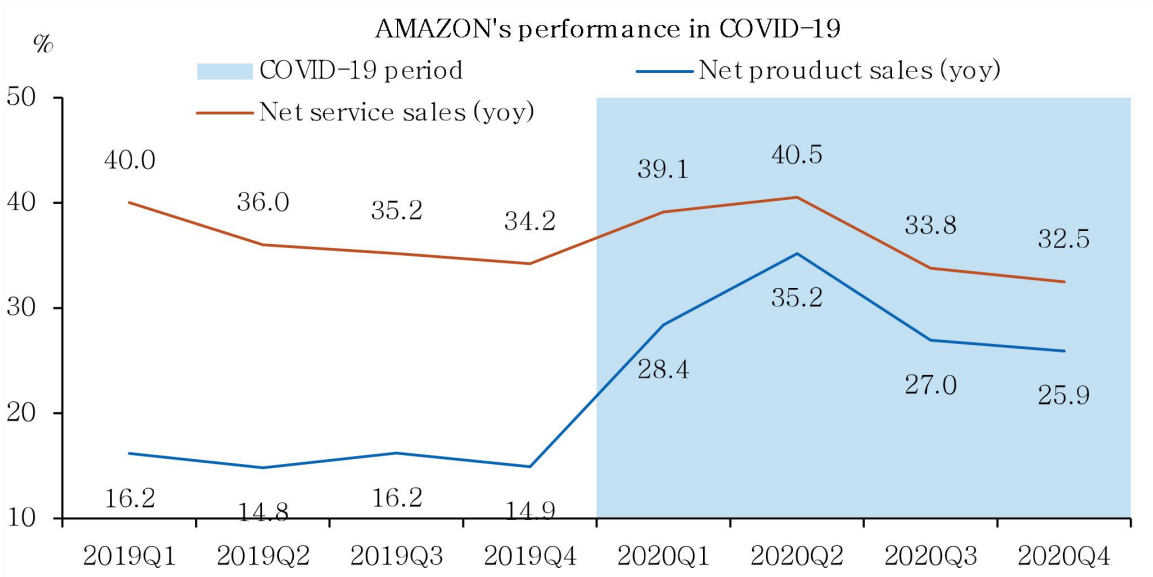
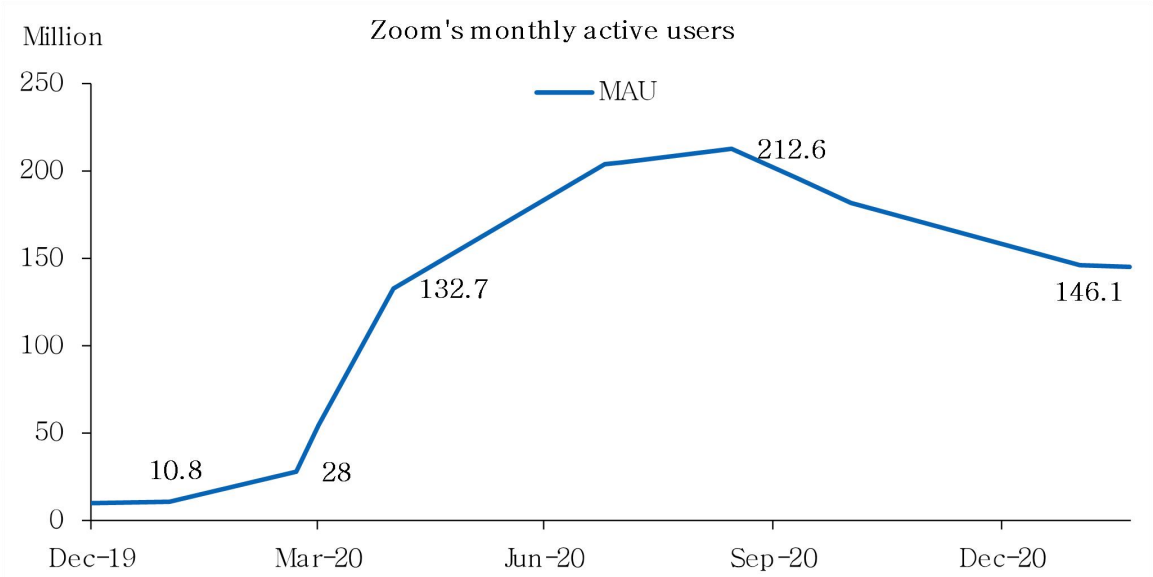


Figure 5: Zoom's monthly active users (MAU)



Another way to think about resilience is as follows: in a pandemic economy, remoteness, which usual means being a long distance away, gets redefined in very local terms. We know that the costs of remoteness, of being far from dense urban centers, in the pre-digital world are relatively high because of the partial disconnection from the physical version of the ICD layer. The digital ICD lowers those costs, and in a pandemic economy that applies to the whole economy, not just the remote parts. In a sense, the

basis of the increased resilience is the same as the inclusiveness properties to which we will turn.

A second dimension of resilience has to do with tracking and containing the virus. Because of the ubiquity of the mobile internet, platforms, and operators of cellular networks have data on location and activity. In principle they can track person to person proximity including duration. If you add data from testing or hospitalization, you have potentially powerful tools for tracking, targeting mobility restrictions, and thus containing the virus while minimizing the economic impact. It appears these tools were deployed to good effect in China and perhaps in a few other Asian countries.

The majority of western countries did not use these tools effectively, mostly because of concerns about privacy and the potential misuse of personal data. That distrust extends to governments in many countries. This is a subject to which we will return: confidence in the institutions, laws, rules and regulations that surround the management of data is a critical precondition for fully realizing the many beneficial uses of "big data."

Platforms are at the center of the discussion of the benefits and potential costs and vulnerabilities of big data, precisely because that is where the data tends to accumulate and flow and be shared. It is not at all surprising for example, that platforms have been the source of much of the innovation in the application of AI and machine learning. They have the data, the incentive to use it to find solutions in new use cases, and the required computing power in the cloud computing systems.[2]

The pandemic economy was not only a large negative shock in macroeconomic terms, but it was also a very large negative shock in distributional terms. Data from multiple economies shows that the magnitude of the negative shock in terms of employment and lost income is highly negatively correlated with income levels. Public policy and fiscal

[2] Cloud computing allows the user to scale up their computing capacity to meet growing demand. Yet in the pandemic, we have seen countless reports of systems collapsing because of spikes in usage. Unemployment insurance application systems crashed, ditto vaccine appointment systems. Admittedly the spikes were large. But so are the peak load spikes on Black Friday and Singles Day.

programs have helped to buffer this shock to some extent. We simply note here that the digital economy and prominently numerous platforms helped limit the size of the contraction and the aided the speed of recovery, which has had an important positive inclusiveness impact. We turn now to inclusiveness and the role of platforms in normal times.

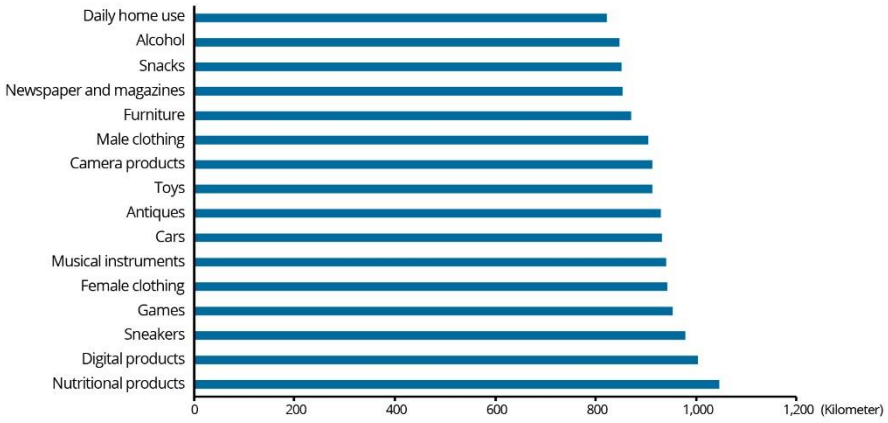
Platforms and Inclusive Growth Patterns

The digital economy in China is in several dimension more advanced than in most other countries. Ecommerce is more highly penetrated and mobile payments are an order of magnitude more developed in terms of use, though the differential has started to decline in part because of a pandemic induced acceleration. As a result, there is a large pool of data with which to study and understand the impacts of platforms in the eCommerce, mobile payments and Fintech space. We rely here on two major reports of the Luohan Academy, in Hangzhou: "The Digital Economy and Inclusive Growth," and "Understanding Big Data: Data Calculus in the Digital Era."

Ecommerce improves the inclusiveness of growth patterns in a number of ways. The platform centered and architected open digital ecosystems have low entry barriers and an organized system of complementary resources and markets for starting businesses. As a result, there is a well-documented expansion of entrepreneurial activity, new busines creation and employment. Taobao for example has roughly 10 million businesses on the platform, about half of the founding entrepreneurs are women. It is not necessary to be in tier one cities to thrive on the platform. The digital ecosystem is there, independent of the precise physical location of the business. The expansion of entrepreneurial startups is by no means confined to China. There is a global explosion of innovation and new growth company formation enabled by the digital economy and especially by the platforms and the data driven digital ecosystems that they create. A key feature is low entry barriers.

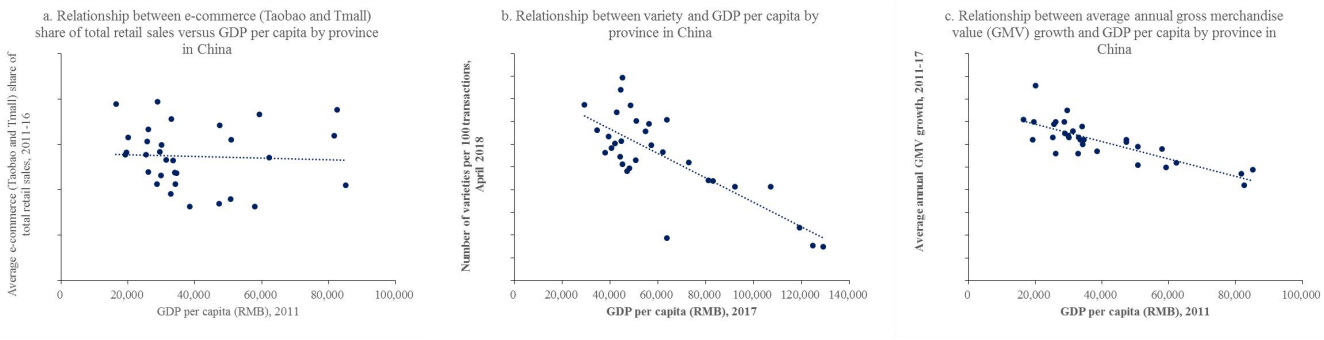
The ecommerce platforms give small businesses access to much larger accessible markets than would otherwise be the case in the offline world. In the offline world in China the average distance between buyer and seller is on the order of several kilometers. In the online world, excluding perishable products, that average distance is about 1000 kilometers (Figure 7). The expansion of accessible markets allows small businesses with valuable products or services to offer to scale much faster and more efficiently. Indeed, in the case of Alibaba, this was a main element in the mission of the enterprise at its founding. Inclusion can become a major business goal in the digital age especially for platform models.

Figure 7: Average trading distance at Taobao and Tmall, 2018



The inclusive effects are not confined to the supply side of the economy. First, across regions in China, there is no relation between ecommerce share of total retailing and per capital GDP, indicating that less developed regions spend proportionally no less than more developed regions in ecommerce (Figure 8). Second, people in less developed regions buy proportionally much larger variety of goods online to offset their location disadvantage. Third, people living poorer regions with limited access to first-rate retail services experience proportionally faster growth of spending on ecommerce than people in richer regions. Therefore, the platforms expand the range of goods and services people can buy, accelerating the connectivity and inclusion in these regions into the economy.

Figure 8: Ecommerce development across most regions in China



Source: Taobao and Tmall; National Bureau of Statistics of China; Luohan Academy.

As people and businesses expand their participation in the digital economy, they leave a digital footprint in the form of data. Breakthroughs in the application of AI and machine learning combined with this expanding pool of data allow small businesses and households to move from being largely anonymous unknown entities, to firms and households with track records and identifiable characteristics. And all of this happens at a very low incremental cost. Data is non-rivalrous and can be used repeatedly without diminution in its value.

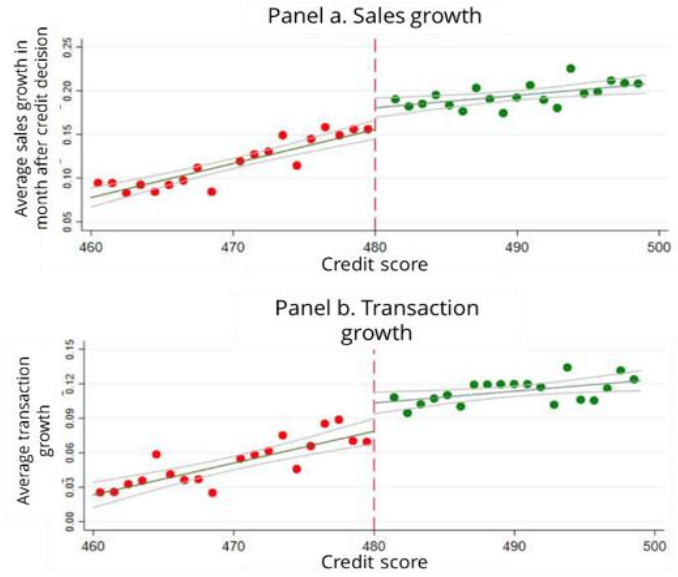
Digital identity is key to build the online marketplaces in which hundreds of millions of customers and merchants make deals with each other, almost as if they were doing so face to face in the same local market. Customers share data to rate every product and procedure of services. All participants produce and benefit from such data exchanges – in sharp contrast to offline "lemon markets" where buyers lack the information that sellers have about the goods and services they are considering for purchase (Akerlof, 1970). Just as data benefits shoppers, it allows higher-quality repeat sellers to better distinguish themselves from low-quality, "fly-by-night" sellers, shoring up their "brand," and benefitting them with stronger sales over time. These systems revolve around the long-term reputation of sellers, which creates an incentive mechanism for the generation of sustainable, high-quality e-retailers on a platform (Tadelis, 2002).

Another good use of data is that, using credit quality assessing algorithms and the large pools of data, credit can be efficiently extended (and priced) to a wide range of lower

income households and small businesses that are effectively inaccessible in the non-digital world through normal banking channels. This is not a criticism of banks. In the offline world, the costs of dealing with these sectors are high relative to the value creation or potential return, and the risks are high because of the absence of any cost-effective way of assessing credit quality. The result is that entities that have little or no collateral and hard (or expensive) to detect track records can be served by the platforms operating in partnership with the banking sector. In the cases of Ant Group, more than twenty million SMEs and startups have had access to micro loans without a penny of collateral, an unthinkable phenomenon in the pre-digital world. It uses a "310" model: It takes an MSE less than three minutes to apply, one second to obtain the loan, and zero personnel to complete the transaction (Luohan Academy, 2019). Similar lending practices have also been conducted at JD.com. As Berg et al. (2020) have found, even simple “digital footprint” information can become a useful supplement to current credit bureau information and thus increase access to credit for unbanked populations.

The inclusiveness of digital lending on platforms is obvious. It has also had a significant real impact on small businesses. Using a lending decision rule of a 480-point credit score, Hau et al. (2018) show that MSEs that obtain lending enjoy significantly higher sales growth than those who do not enjoy such access.

Figure 11. Sales Growth After Credit Approval



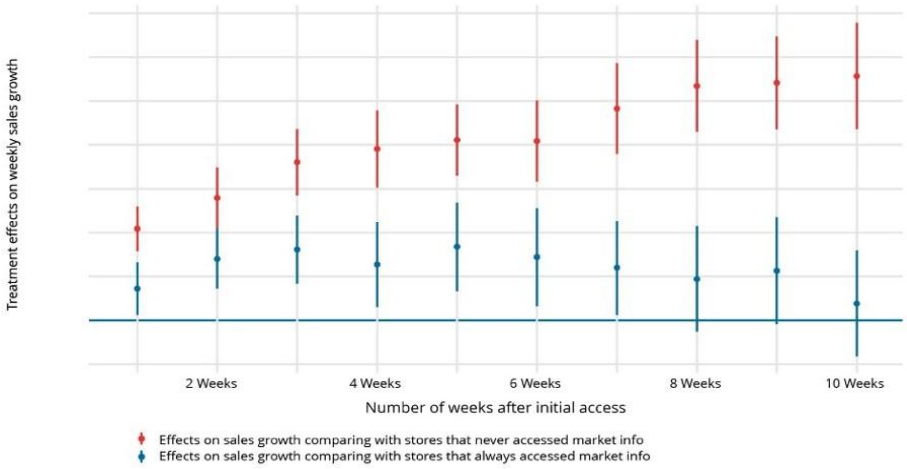
Note: The data sample period is from September 2014 to July 2016. Source: Hau et al., 2018.

A third use case involving data is interesting. It concerns what are sometimes called recommendation engines on the platforms. Like the credit use case, this involves the use of personal data in combination with larger pools of data on purchasing patterns. Recommendation engines (or REs for short) essentially use these pools of data to make predictions about what specific customers may be interested in.

On the business side, REs are essential for small business to grow. Digital platforms such as Taobao, JD.com, Amazon, and eBay all provide information services to help merchants make business decisions. Consider Taobao's Business Advisor, a service available to all online store owners. It provides business owners with useful analyses, such as those of their historical performance, market trends, and market competition. According to Luohan Academy (2019), about 90% of online sellers with monthly sales greater than RMB 300,000 (USD 44,000) are subscribers to the Business Advisor. New subscribers to the Business Advisor, most of whom are SMEs, immediately benefit from

the availability of customer and market information. Becoming an active user of Business Advisor, i.e., starting to access data on a store's own performance, is associated with approximately 15% higher average weekly sales. One extra day of tracking per week is related to 6.9% higher annual sales. New subscribers significantly outperform non-users. Their weekly sales are about 13% higher in the tenth week after the start of subscriptions. In short, big data helps SMEs gain business analytical tools that used to be the privilege of a few large corporations who could afford the expense.

Figure 12. The Effects of Acquiring Market Information on Weekly Sales Growth



Source: Luohan Academy (2019)

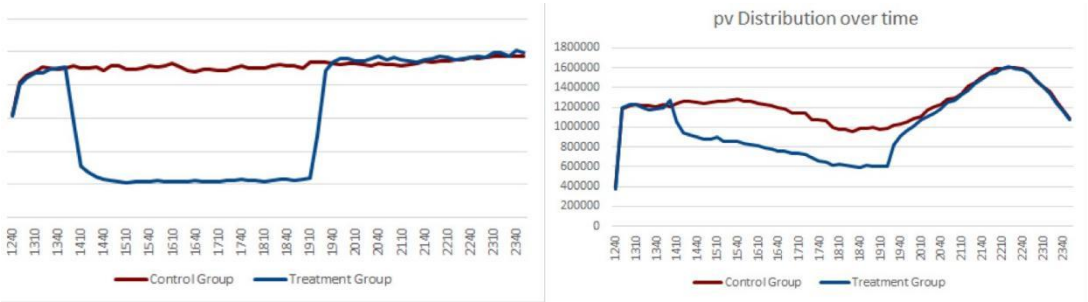
On the consumer side, REs are indispensable for consumers to find preferred goods among billions of options. This is equivalent to a know-your-customer (KYC) representative making suitable recommendations based on understanding the customer. To understand what would happen if such recommendations are made without personal information, i.e., without knowing anything particular about the customer, Sun et al. (2020) conducted a controlled experiment to see what happens when you turn the recommendation engines based on personal information off, meaning you deny the engine access to personal data on purchasing patterns.[3] These are controlled experiments

[3] Reference to the Big Data Report

in the sense that a randomly selected subset of users have the personal information portion of RE turned off, and the results are then compared to the remaining customers where the RE is still fully running.

Several interesting things emerge. The RE's without the personal data converge quite quickly to the few hundred products with the largest market shares on the platform – in other words they are largely not personalized. Statistically not surprising but still important. The lack of personal data led to a drop of 77% in the click-through rates and the number of product views fell by 33% (Figure 18). As the products shown to consumers were not so attractive, the number of searches increased significantly (Figure 13). And that fall off is more substantial for smaller businesses and less well-known brands. In other words, turning off the RE diminishes effective communication of product differentiation and hurts the smaller sellers most. Or put the other way around, REs enhance relevant product differentiation, increase the efficiency of markets by improving the precision of the matching function, and deliver larger benefits relative to scale to the smaller sellers and brands.

Figure 13. User Click-Through Rates and User Product Views



Source: Sun et al. (2020).

As an aside, there is a literature in economics that deals with undetectable product differentiation and its impact on market outcomes and performance. The phenomenon is called "adverse selection." This is not the place to delve into the subject in depth. But it is worth noting that generally, digital platforms using big data, including personal or

institution-specific data, can and do close the informational gaps and asymmetries that underly adverse selection and moral hazard, with beneficial effects on market performance and inclusiveness.

We note that the role of platforms and data on inclusiveness in important social functions, is not confined to ecommerce and fintech. There are important use cases in education and health care for example. There are now unicorns (startup companies with market capitalizations of $1B or more) in education and health care. Some in education are delivering services to low access populations, while others are matching programs or services to the specific needs of individuals or subsets of the population served. In health, image recognition algorithms are being deployed to augment the reach of primary care in the health sector by early detection of diseases like skin cancer and diabetic retinopathy. This pattern of innovation with platforms and data at the center seems set to continue over a wide range of sectors. In fact, it feels more like the beginning than the end.

The benefits of platforms especially in ecommerce and fintech in stimulating innovation and new company creation and scaling, depends on the openness of the platform and the ecosystem that develops around it. That is to say, it depends on the mission or purpose and the business model of the platform. Platforms that vertically integrate to compete with existing users of the platform on the supply side, or that block access to new entrants who may have a competing offering with respect to a service delivered by and on the platform does not result in a good alignment of the platform business model with broader economic and social development goals. There may be cases in which a platform will choose to invest in an upstream sector to stimulate growth of that sector's integration into the digital economy. An example might be food retailing, where the traditional industry may be initially slow to get on board. But the goal should be to accelerate the process and not to achieve platform dominance in that digital ecommerce sector.

Platforms and Personal Data: Data Security and Privacy

The benefits of the use of data, especially personal data, and mainly by platforms in a growing array of use cases are relatively easy to document. Measuring the benefits in a way that synchs up with traditional measures of economic performance, like growth, productivity, or broader measures of well-being is a different story and a greater challenge.

But one thing is quite clear. It is that achieving these benefits to the economy and more broadly to well-being, depend up people's willingness to share personal data and that in turn will depend on their degree of confidence (or its absence) that their personal data will not be misused or subject to unanticipated or unauthorized use.

There are really two complex issues here: data security, and appropriate levels of privacy in specific use cases. So, security first.

Security is crucial. It deals essentially with theft, with the unauthorized access and potential use and abuse of personal data; here unauthorized means without acceptance by either the user or the platform or the App operating on the platform. The Big Data Report describes technological solutions that materially advance the protection of Platform data. The problem is to ensure that state of the art protections are implemented across the participants in the digital ecosystems, and not just on the central platform, important as the latter is. That this is a serious problem is not in doubt. To quote from the Understanding Big Data report,

> The number of data breaches and exposed records worldwide reached 1.6 billion in 2017, causing great consumer privacy concerns as well as huge economic losses.

The date assaults included sensitive data held by governments, ransomware attacks which threaten data destruction and more. It seems to us that one main challenge is to find a way to incentivize or require adoption of best practices among the many entities that acquire and store data. Cautionary consumer behavior (here the consumer is the source

and subject of the data) on one side, and building of trust through good practices on the platform side will help. But it may not be sufficient. Some regulatory standards may be needed to supplement private incentives.

Privacy is a more complex set of issues that are being worked through in multiple societies. Here the issue is not theft, or sloppy security, but rather rights and responsibilities that surround the acceptable management and use of data. It is a complex but very important subject.[4]

Data has value when it is pooled and shared. Locked in silos it has very little incremental value. Closely related, trying to solve the issue by determining who owns the data, isn't helpful. The key is to give users options to share and to opt out, and protect privacy well when in use.

The emerging ingredients in the privacy area are trust and reputation, transparency, and regulation that codifies the rights of various parties in platform economy. As the report, "Understanding Big Data" notes, the Fair Information Practices (FIP's) promulgated in the early 70's by the US Department of Health Education and Welfare, have stood up pretty well. Though originated prior to the digital revolution, responsible management of data predates the platform era. To quote from the Big Data report.

> Modern privacy protection builds on Fair Information Practices (FIPs) originated in the early 1970s at the United States Department of Health, Education, and Welfare (HEW). They were based on five principles: "(1) Notice/Awareness; (2) Choice/Consent; (3) Access/Participation; (4) Integrity/Security; and (5) Enforcement/Redress" (United States Federal Trade Commission, 1998).

[4] Here we rely heavily on the recent report from the Luohan Academy, "understanding Big Data: Data Calculus in the Digital Era, and a growing set of studies and policy initiatives."

As noted in the report, the purpose of the FIP's was not to lock up data, but rather to promote the secure and privacy-protected flows. As the Platform economy grows in scope and influence, data regulations are proliferating. That by itself is not bad. However, there is some risk that as they develop, they will restrict potentially valuable flows of digital information. That said, moving data around, transferring and accessing them is much less cumbersome in the digital economy. Thus, there is some urgency to getting the balance between privacy rights and beneficial flows right.

Data governance is a work in process, but a few things are now clear. Data privacy will not be left entirely to the private sector and specifically to platforms. Regulation is coming setting standards mandating disclosure and transparency with respect to the use of data and who will have access to it, giving subjects some rights with to the use of personal data, and the so-called right to be forgotten. Regulations can also be expected governing the physical locations where data is stored. The reason is that countries or regions will not have identical regulations, an added element of complexity for platforms that operate in multi jurisdictions or even across borders. The regulators will want to have some leverage in enforcing data regulations. Localized data requirements are one way to achieve that objective. They may also feel that cyber security more generally may be enhanced with the same local storage of data requirements.

Data restrictions on cross border flows, if they materialize, have the potential to complicate and even interfere with the management of global supply chains which increasingly operate on digital foundations, an require data mobility. Data regulations need to tread lightly and carefully if they are to avoid unintended negative consequences. It has become quite clear that international agreements governing cross border data flows are needed to prevent fragmentation of valuable international commerce in the digital economy.

Platforms and Market Power

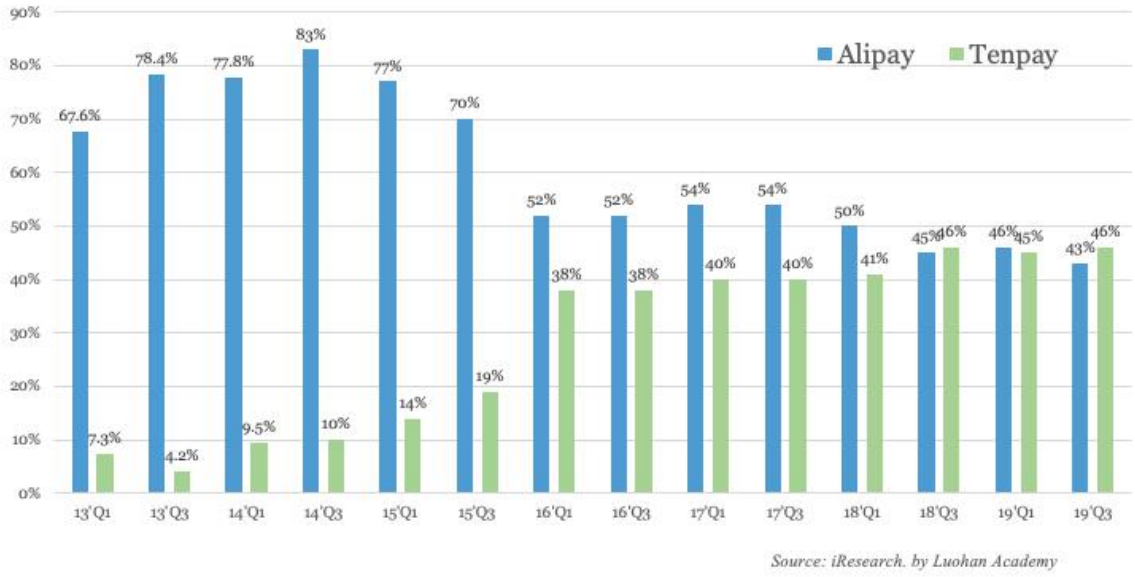
Here we will be somewhat brief. It is clear that mega platforms, as the architects of the marketplaces and the ecosystems that get built up around them, in principle have the power to exclude. Whether they have an interest in doing that is a different question. We have already noted that open platforms that encourage innovation and new entrants are highly profitable, have generated a great deal of value for shareholders, and at the same time, support inclusive growth patterns. We also asserted that it is generally not in the interests of the platform to stray too far into the territory in which they are in direct competition with other users of the platform.

The power of platforms comes several sources; one is from network effects: users want to be in the same marketplace, on the buying and selling side. This is not peculiar to the digital economy. In the offline world, major urban centers enjoy the same advantages. However digital platforms have some other advantages. Using data, repeat purchasing or selling behavior, two-way evaluation systems, recommendation engines, and credit scoring algorithms, they close information gaps and shift incentives in a way that increases market efficiency and inclusion. That gives the large platforms with lots of data and advantage: these are functions that are not possible (or not to the same extent) in the offline ICD layer.

That said, China is an interesting and instructive case in the following sense. It has significant platform competition in ecommerce, mobile payments and fintech. Of course, it is a huge economy and market, so this may not be possible to the same extent in smaller markets. But it does suggest that the benefits of scale in terms of market power are not unlimited, and that good ideas can scale quickly and compete.

The competition between Alipay and Wechat Pay provides an example of competition in the platform space. As the "first-mover" innovator of digital payments in China, Alipay accounted for close to 80% of online payments in 2014. But by 2019 its market shared had shrunk steadily to 43% as Wechat Pay quickly caught up (Figure 16). Again, in many areas, an early advantage through successful use of big data does not necessarily take online platform companies to the land of winner-take-all.

Figure16. Market Share in China's Mobile Payment Market



One area of concern is potential stifling of innovation in new products and services which are best brought to market via the large platforms and that could be blocked by a platform manager that wants to control or exclude competition in certain areas. Here vigorous application of competition laws and policy seems to be the right course. We note in passing that on the consumer front, there is little evidence of the abuse of market power in the form of excessively high prices charged to participants on the platform – even in these two-sided markets.

The mega platforms, which are the source of much of the innovation, at present reside mainly in China and the United States. This is not inevitable. A reasonable expectation is that at least other large markets including India, Europe and Latin America will emerge as hosts to major players in the platform economy. Latin America already has highly competitive ecommerce and payments platforms.[5]

Platforms and Sustainability

[5] Mercadolibre and Mercado Pago based in Argentina and operating throughout Latin America has very similar characteristics to their American and Chinese counterparts.

Globally, people recognize that the world is facing an existential threat with climate change and CO2 and other greenhouse gas emissions. And there are other areas of environmental and ecological damage that are also of great concern. The challenge is daunting. Bringing CO2 emissions down fast enough to prevent a calamity is a huge challenge. The current commitments under the Paris Accords are reported by the UN to be insufficient to achieve the objective of limiting temperature change and all that goes with that to 1-2 degrees Celsius. The fossil fuel related emissions globally are in excess of 30 gigatons per year, which is way higher than anything that is deemed to be stabilizing.

The good news is that green energy costs (solar and wind) have skyrocketed downward and are competitive with or superior to fossil fuels, especially coal. Incremental electricity generating capacity can be built with green technology, in emerging markets, making a major contribution to mitigation. Just as important, the entire world, governments, business, and society generally has developed a sense of urgency behind this effort and made commitments for which they and we need solutions. The demand is very high.

The platform economy has a major contribution to make. An increasing fraction of transactions are executed on platforms leaving a digital footprint of enormous potential value. It can be used to incentivize green behavior among consumers and businesses.

The case of Ant Forest is an interesting example. On August 2016, AliPay officially launched the public welfare project called Ant Forest: the carbon emissions reduced by everyone due to greener lifestyle can be calculated as virtual "green energy". After accumulating to a certain extent, a real tree can be planted in desertification areas, or a square meter of protected land can be "claimed" in areas where biodiversity needs to be protected. The green activities include more than 30 kinds, covering from paper reduction and plastic reduction, online business, green travel, recycling and other aspects.

By the end of 2020, Ant Forest has attracted more than 550 million people, with a cumulative carbon emission reduction of more than 12 million tons. More than 220

million real trees have been planted in desertification areas. At the same time, Ant Forest has set up 13 public welfare protection areas across the country to protect biodiversity through "one square meter for everyone" and provide shelters for endangered animals.

Globally, platforms can do many more things to further the climate agenda. Some specialized kinds including auctions will be important elements in integrating smart and decentralized electricity grids. These grids are required to coordinate the supply of electricity form a variety of sources, whose contributions ebb and flow with supply conditions and local demand.

Specialized platform-based systems, and algorithms will also be key elements of critical goals with respect to energy efficiency. Energy efficiency is of course, about structures and materials, and how we move around and interact. But it is also about how we use these systems. These goals will not be achieved if every structure needs its standalone highly specific digital energy management system. One needs platforms that deliver customizable energy management services, and data that can be used to create or enhance incentives.

In sum, the NetZero world that we hope to achieve sooner rather than later, requires not just innovative technology in the energy space in the tangible layer, but also an incredibly sophisticated digital ICD layer to govern it and make it work. Platforms have three characteristics that give them a central role in this and other domains. They have very low marginal costs, so that once their core operating characteristics are in place, they scale easily. And second, in applications thus far, Platform centered ecosystems appear to be superb tools for coordination of economic activity, in many ways superior to humans in managing and adapting highly complex systems. Finally, and most importantly, they are networks that coordinate unprecedented number of consumers and businesses whose efforts are crucial for a greener planet.

Platforms and Political and Social Discourse

We conclude with some thoughts on platforms as they become the major forums for social interaction, political discourse, and news or what passes for news. Much of this is benign and has significant positive value. People can be better informed, stay in touch with friends and family, enlarge the circle of connections and interactions, form groups based on common interests of all kinds, and organize group activity.

But it is also true that the content on the social media platforms appears to have had a profound effect on social and political structures and processes. There is content that is or can be viewed as destructive and polarizing, and ultimately damaging to political and social stability. There are actors in these systems whose objectives include sowing social division. Some of those actors are neither residents nor citizens. And at least in some places, representative democracy, and delegation of authority to experts with accountability, seems to being replaced by digital enabled and highly divisive form of populist governance.

It is increasingly clear that the social media can provide powerful tools for the pursuit of special interests, for fomenting descent and division and for manipulating news and information flows. Thus, an earlier vision of an open, unregulated and unfiltered internet in terms of content, with largely benign outcomes is no longer realistic. In thinking about internet content especially on social media, every society is going to have to confront tradeoffs and the balancing of individual rights and collective interests. The notion that they are always in alignment has proven to be untrue.

These are very difficult issues. In many countries, individual rights (including relatively free speech) are embodied in the constitution. Organized pursuit of collective interests (think of security and stability) generally belongs to the government. But if one asks what institutions are constitutionally endowed with the authority to strike a balance, when needed, between these rights and collective interests, the answer in many countries, is often quite unclear. Probably the judicial system is the closest thing to an answer in some countries. Certainly, delegating internet content management to Platforms themselves, with or without guidelines is not going to be work, or be perceived as legitimate.

It seems highly unlikely that a hands-off, laissez-faire approach to internet content that characterized the early days of the WWW, will continue. Beyond that, it also seems clear that different approaches across countries and regions will emerge, based on divergent values and governance structures. Convergence in this area does not correspond with current trajectories. If content regulation diverges across the global system, a corollary is that some degree of fragmentation of the global internet is inevitable. Full global integration in the digital ICD layer won't happen.

Brief Conclusion

The digital transformation of economies and to some extent societies, consists mainly of the introduction of powerful machines into the ICD layer of the economy for the first time. Platforms are the digital version of the marketplaces and exchanges that are essential to the functioning of any economy. As such they are an essential part of the digital infrastructure of the economy. Platforms are usually created, architected, managed and updated by firms. Their business models vary and align to varying degrees with the public interest. In many ways, an organized system of markets and exchanges is a public good. Regulation in multiple dimensions as discussed above is now understood to be necessary to ensure this alignment. But innovation is also important. Responsibly and transparently used, data or digital information is an enormously promising and powerful tool for promoting inclusive and sustainable growth patterns globally. And platforms, thus far, are the key delivery mechanisms. While being regulated, they also need to be understood, and nurtured and allowed to innovate.

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