Berkeley
UNIVERSITY OF CALIFORNIA

BERKELEY ROUNDTABLE ON
THE INTERNATIONAL ECONOMY

BRIE Working Paper
2019-11

The Platform Economy Matures: Pervasive Power, Private Regulation, and Dependent Entrepreneurs

Martin Kenney, Dafna Bearson, and John Zysman

Acknowledgements: This research was funded in part by the Ewing Marion Kauffman Foundation with additional support from the German Federal Ministry of Labour and Social Affairs (BMAS). The contents of this publication are solely the responsibility of the authors.

The Platform Economy Matures:
Pervasive Power, Private Regulation, and Dependent Entrepreneurs

Martin Kenney, Dafna Bearson, John Zysman

Abstract:

Platforms are an emblem and embodiment of the digital era just as factories were of the industrial revolution. Digital platforms, through their power in their respective ecosystems, are intermediating and contributing to the reorganization of ever-greater segments of the economy and society. As this occurs, existing firms, jobs, and labor relationships are being displaced or transformed, even while new tasks and enterprises are emerging, and existing firms are adjusting. This paper explores the ways in which platform firms are insinuating themselves into ever more parts of the economy. These platforms are integrating existing firms and service providers ever more tightly into their orbit. Existing firms, paradoxically, benefiting from and challenged by platform firms, are facing difficult adjustments to their role and power in their respective value chains.

The specific impact of platforms in particular cases is evident. Assessing the impact of the rise of the platform economy on the broader economy is more difficult, despite the acknowledged increase in amount of commerce conducted through or affected by platforms. To measure the sheer breadth of the economic activity affected by platforms, it is necessary to consider the diversity of platforms throughout the economy, the size, as well as the power of the ecosystems controlled by dominant platforms. The expansion of the scale and scope of platforms has implications for inter-firm competition and for which firms capture the value generated by economic activity. To that end, we illustrate the extent to which platforms are intermediating a large share of economic relationships across the economy. We present a framework for understanding of the impact of digital platforms on society and provide evidence of the power

that platforms possess. To provide a granular analysis of the vectors of the expansion of platform power, we use a case study of Amazon to demonstrate the ways in which it affects a wide variety of industries.

We argue that platforms are private regulatory structures for those connecting or transacting through a platform. Such structures constitute a web of private regulation that organizes and shapes economic activity with little or no public oversight. The enormous reach of these platforms and their "regulator-like" power within their ecosystems compel us to consider whether private platform regulators are replacing many of the state's functions.

I. Introduction

Platforms are an emblem and embodiment of the digital era just as factories were for the industrial revolution (Kenney & Zysman, 2016; Rahman & Thelen, 2019; Snircek 2017). Digital platforms are proving to be levers for reorganization of ever greater segments of the contemporary economy. As this occurs, existing firms, jobs, and labor relationships are being reorganized or eliminated, even while new tasks and enterprises are emerging, and existing firms are adjusting to the changes wrought by platforms. Above all, platforms are introducing new arrangements for value creation and capture and have their own institutional logics (Frenken, Vaskelainen, Fünfschilling, & Piscicelli, 2018). One way to conceptualize the effect of platform firms is as a rewiring of the circuits of the economy.[1]

The specific impacts of particular platforms on the market and society are evident and well documented (for recent examples, see: Cabral, Peitz, & Wright, 2019; Rahman & Thelen, 2019; Berger, Chen, & Frey, 2018; Ticona, Mateescu, & Rosenblat, 2018). Just glance at

[1] Manuel Castells (2013) recognized the ways in which ICT was changing the organization of the capitalist economy.

Google, Facebook, Amazon, and Salesforce whose multiple platforms have diverse impacts through the economy. It may be relatively easy to gauge the impact of Expedia, Uber, and Airbnb on the particular market segment in which they are rooted; Expedia – travel, Uber – transportation, or Airbnb – accommodation. Yet the value for a platform is generated, not only by its own activity, but also by the often vast ecosystem that emerges around it and adds value to the platform (Cusumano, Yoffie, & Gawer, 2019; Parker et al., 2016). For the larger platforms, these ecosystems can be quite complex and contain a diversity of actors that depend upon and generate value from the users that the platform attracts.[2] Given the size and complexity of these ecosystems and the various levels of attachment to the platform by the ecosystem members, it is difficult to gauge the size and impact of various platforms on the economy.

In this paper, we first consider the size and complexity of platform-based ecosystems. We then turn to the issue of platform power and platform governance (Tiwana, Konsynski, & Bush, 2010), the substantive core of this paper. Platform governance can be understood as having two aspects: artifactual and contractual. The artifactual aspect is inherent in the software and algorithmic structure of the platform. As Lessig (1999) points out, the software itself structures action – it enables certain activities and blocks others (Barrett, Oborn, & Orlikowski, 2016). Gauging governance is even more difficult, because the platform owner can change the code and algorithms at will, thereby reengineering the terms of engagement for all platform users. In addition to the algorithmic structure, platform users contractually agree to a set of terms and conditions. The typical terms and conditions reserve essentially all powers to the platform owner. The algorithmic affordances and contractual conditions provide platforms nearly total control over users and firms utilizing the platform – it is private property.

[2] For a discussion of the power that these platforms exert over the complementary members of the ecosystem, see Cutolo & Kenney (2019).

Because many platforms operate in winner-take-all or winner-take-most markets, for firms in markets that organized by platforms participation is, essentially, obligatory (Caillaud & Jullien, 2003; Katz & Shapiro, 1994; Shapiro & Varian, 1998). To illustrate, for any organization, being discoverable through Google Search is necessary to be in business. It is so important that a new industry and occupational category has arisen, namely, search engine optimization (SEO). Of course, SEO is, in fact, Google SEO. Put differently, websites are optimizing themselves to be found by Google – this is not a choice, it is a condition of being in business.

The impact of platforms on particular business sectors is already evident. For example, the newspaper industry in the U.S. has experienced a disastrous decline, first due to the Internet, where the early platform firms such as Craigslist moved classified advertising online. Later, Facebook and Google increasingly became the intermediaries by which people accessed their news and both firms attracted advertising from the traditional media (Cho, Smith, & Zentner, 2016). More recently, Google has become the preferred advertising channel for local businesses. Assessing the impact of the proliferation of platforms on the broader economy is difficult, as they can intermediate different aspects of industries and their constituent firms and their activities. All of these developments open the question about the role of the state in a world where platforms are becoming private, but interested, regulators over increasing swathes of the economy.

A. The Maturation of the Platform Economy

Today's digital platforms are a product of the ongoing digital revolution. The developments in data processing and digital communications have matured from platforms such

as Microsoft Windows and game consoles that had powerful but limited impacts on the entire economy. One of the earliest indicators of the power of platforms to shape business was their emergence as intermediaries between customers and vendors in the late 1990s. At the time, few understood how powerful search funded by advertising would become and the size to which online markets would grow. Technical developments such as the introduction of the smartphone connected many more people to the Internet, freed the internet and users from the Microsoft-controlled personal computer, and made possible the full-blown platform economy. The communications-based and networked digital platforms on which we focus on here are ever more powerful as they connect billions of people to other people, firms, and objects.

With the power of network effects, platforms are increasingly intermediating a remarkable variety of economic activities and, using the power of data and algorithms for analysis, as they penetrate and become intermediaries in one economic sector after another. The most powerful of these platforms have been able to transcend industrial boundaries to enter new sectors (Eisenmann, Parker, Van Alstyne, 2011; Parker et al., 2016). As we will show in the case of Amazon, digital technologies create affordances that make possible unexpected expansion paths (Henfridsson, Nandhakumar, Scarbrough, & Panourgias, 2018). To presage our argument, Amazon began as a bookseller, but now sells millions of products, and also is a provider of cloud services, physical logistics, while allowing merchants to sell online through its platform. On the surface, it appears to be an incoherent conglomerate aggregating an enormous variety of services. However, all of these are meshed together through data, software, and processing power. Due to network effects, it has become a necessary sales channel for online-only startups, small-established firms, and giant corporations alike. As another example, by

leveraging Search and Maps, Google has replaced the Yellow Pages as the crucial intermediator for local services and global discovery.

From one vantage, there is little need to depict the scale and breadth of these platforms, as our lives are increasingly conducted in a fabric of platforms – to paraphrase Marc Andreessen, it is not software per se that is consuming the world, it is the platforms (Parker et al., 2016). The power and reach is almost too large to fathom – Facebook and WhatsApp, Google Search, the Chrome browser, Android, YouTube, and Maps, Amazon serve in excess of 1 billion persons every month. Not surprisingly, the channels of traditional opinion formation (the mainstream press, television news, and radio talk shows) have been displaced by receiving algorithmically selected "information" from social media (Van Dijck, 2013). The role of Google in finding things through search, maps, and even Google Scholar has made it the intermediary that determines existence. If something cannot be found through these services, it does not exist. Beyond "mega-platforms", there are sectoral platforms that include Uber/Lyft for transportation; Booking.com and Expedia for travel and accommodations (with a new entrant, Airbnb); Netflix, YouTube, Spotify, and many more for social networking, entertainment, and specialized markets of all sorts.

For non-platform businesses, platforms increasingly shape how customers find and interact with them, how they hire, handle paperwork (information and data), connect with customers, and ship products. For *workers* – whether employee, gig worker, or contractor — platforms are increasingly organizing the labor market. The pervasiveness of the impacts are remarkable and range from Amazon Mechanical Turk for micro-work through TaskRabbit or

Lugg for various chores to Upwork for tasks requiring more skills (for a classification of platform-mediated work, see Kenney & Zysman, forthcoming).[3]

Earlier studies of labor were focused on gig (Graham, Hjorth, & Lehdonvirta, 2017; Huws, 2018) and sharing platforms (Frenken & Schor 2017; Schor 2016; Sundarajan, 2016). More recently, with the reconceptualization of the central institution in a transformed economy, the platform, discussion turned to including far more transformational mega-platforms such as Amazon, Facebook, Google, and, in different ways, Apple and Microsoft. For this reason, our discussion, while recognizing the importance of gig and sharing economy firms, such as, Upwork and Fiverr, explores the far more transformative effect they are having through their services and strategic growth paths, on labor and value creation and capture. This allows us to explore how platforms are becoming a general organizational feature for large parts of the economy and social life.

At its core, this paper aims to open the discussion about the larger effect of platforms on labor and society by exploring and illustrating the pervasiveness and power of the various platforms. By using the two dimensions, pervasiveness and market/social power, we provide a lens through which to understand the digital platform transformation. To achieve this, it is necessary to understand both the structure of the platform firms and the ecosystems of value creation that coalesce around successful platforms.

[3] Other classification schemas have been offered. Fumagalli, Lucarelli, Musolino, & Rocchi (2018) identify six main types of platform firms based on the ways that firms generate income, for instance, advertising-based, work-based, or product-based. Kalleberg & Dunn (2016) classify "gig" companies according to the following four categories: crowdwork, transportation, delivery and home tasks, and online freelance platforms. Forde et al. (2017) and Manyika et al. (2016) classify platform workers with respect to their level of dependence on platform-generated income. Eurofound (2018) identifies ten types of platform work based on three criteria: 1) remote versus local, 2) routine versus specialized, and 3) who determines the work (e.g., worker or platform. Finally, Howcroft & Bergvall-Våreborn, (2019) suggest a two-by-two matrix based upon method of compensation, i.e., paid or "speculative," and whether worker or "employer" initiated the contact.

II. Platforms: Pervasive and Permeating the Economy

Platforms are pervasive and transformative features of the contemporary economy. Yet, digital platforms as tools are only now maturing. It was only a few years ago that we could speak of "The Rise of the Platform Economy (Kenney & Zysman, 2016)." Robert Solow has famously quipped that he saw computers everywhere, except in the productivity statistics (Solow, 1987). The same is true of digital platforms: they are everywhere, yet systematically documenting their presence with traditional statistics is challenging. Thus, two questions are posed: How embedded are digital platforms in the economy, and, conversely, how embedded is the economy in digital platforms?

Contemporary statistics are not organized to capture the systematic spread of platforms across the economy. Indeed, many digital platforms are awkward to categorize in the first place. For example, consider e-commerce: many of the firms that intermediate travel (e.g. Expedia, TripAdvisor) operate as platforms linking sellers and buyers, whereas clothing brands (e.g., Nike or Peruvian Connection) conduct business through their own websites that are not platforms. Moreover, it is difficult to assign platforms to particular sectors since one of the fundamental features of the business strategies of many is to recombine and redefine activities usually assigned, statistically and, in common parlance, to different sectors. To avoid this ambiguity, we define digital platforms simply as online markets with *at least* two sides (Hagiu & Wright, 2015; Rochet & Tirole, 2003).

A. Platform Pervasiveness

Identifying the types of economic activities impacted is difficult; however, it is clear that digital platforms are permeating the economy (Furman & Seamans, 2018). A growing body of

literature seeks to outline the dimensions of platform presence in various sectors of the economy (Riso, 2019).[4] For the most part, this has been done through identifying the most important platforms listed on stock exchanges (Cusumano et al., 2019), employment effects of particular platform firms (Hall & Krueger, 2018; Zervas, Proserpio, & Byers, 2017; Popiel, 2017), or the contributions of "free" digital services, many of which are platforms, to traditional economic indicators, such as GDP (Brynjolfsson, Collis, Diewert, Eggers, & Fox, 2019). The strength of these estimates is that they are narrowly focused, but for this reason, they miss the transformative business impacts of digital platforms. Platform-organized markets, very often, have winner-take-most dynamics that result in a few platforms capturing the bulk of a market (Eisenmann, Parker, Van Alstyne, 2006; Gawer & Cusumano, 2002), but they also use their position to enter adjacent markets.

In this section, our goal is to provide a comprehensive overview of how platforms are shaping business. For example, the previously cited studies did not consider how platforms leverage their dominance in one activity or market to expand into adjacent markets. Moreover, digital technologies redefine what an adjacent market might be. As Section 3 illustrates, Amazon expanded from a bookseller into a number of other sectors including logistics, cloud services provision, and entertainment. Similarly, Uber has attempted to expand from ride hailing into delivery and work placement,[5] while Booking.com expanded from hotel booking into car, taxi and airfare reservations. In one interesting application of a platform, researchers have shown that Google Streetview's image of a house is a better predictor of the inhabitant's car accidents than commonly used insurance models (Kita & Kidziński, 2019). As the previous example shows,

[4] For a comprehensive review of scholarly literature on platforms, see Annex 1 in "Mapping Contours of the Platform Economy" (Riso, 2019).
[5] To view the official announcement from Uber regarding Uber Work on October 2, 2019, please visit: https://www.uber.com/blog/chicago/uberworks/.

general-purpose platforms such as Google transcend sector boundaries and are present in an enormous variety of markets. In order to understand the effects of platforms on the economy, their spread into sectors beyond those most evidently affected must be considered.

To broadly understand the presence of platforms across the economy, we undertake an exercise to capture the widespread presence of platform businesses in the economy.[6] First, we identify 31 of the most important digital platform firms (Appendix Table 1). Second, we examine whether a platform is affecting business in all 640 service-providing sectors identified in U.S. NAICS codes.[7] Based on this exercise, we find that these 31 platforms *affect economic activity* in 82% of the service sectors included in our sample.[8] The results suggest that platform firms may affect more than 12 million U.S. business establishments out of a total of over 17 million establishments. We believe our results are a lower-bound estimate for platform presence across the economy, since we did not consider the goods-producing sectors, though many of them are being subtly affected by the presence of platforms. Nonetheless, the number of six-digit NAICS code affected attests to their remarkably broad presence. This survey indicates the far greater pervasiveness of platforms than has been previously understood.

To measure the pervasiveness of platforms, we ask whether their presence affects competition in that particular sector. We distinguish between whether the platform directly or indirectly competes with incumbent establishments in the particular sector. To determine

[6] Paper that develops this methodology forthcoming.

[7] Our focus here is on all service-providing sectors of the economy. Since, in aggregate, service-providing industries represent two-thirds of all NAICS industries and 86% of employment in the U.S., even an incremental change in the role of platforms in service-providing industries will have significant consequences for the processes of value creation and impact significant numbers of workers. We focus on service-providing sectors because platform presence is most visible as platforms tend to intermediate services. Our industry analysis is at the NAICS 6-digit level, which is the most granular industry decomposition available.

[8] We estimate the share of sectors that *may* be affected by platform businesses. We do this by matching economic sectors at the NAICS 6-digit level to platform establishments that have a presence and are affecting economic activity in that sector. Our matching exercise allows us to consider platform presence in sectors where it is already documented, but also in sectors that are less visibly affected by platforms. Through this exercise, we are able to roughly estimate the share of economic sectors that may be affected by platforms.

whether competition from platforms is direct, we consider whether platform entrants capture transactions directly from the incumbent businesses. For example, brick-and-mortar retail clothing stores face direct competition from the Amazon Marketplace. To determine whether an industry is indirectly affected by platforms, we consider whether the platform entrant has changed the mechanisms through which incumbent businesses transact. For example, Google Reviews and Yelp provide information and direct access to restaurants on their listing, however, they do not sell directly through their platform -- therefore they are classified as indirect impacts (Table 2). Among the NAICS code sectors included in our analysis, 46% are directly affected by platform competition, while 37% are indirectly affected. Though we measure the effect on one dimension, in many cases, there can be multiple impacts. To illustrate, Yelp and Google Search reviews are increasingly consulted by potential customers. Many restaurants have adopted OpenTable (Booking.com) as their online reservation platform, and firms such as DoorDash and UberEats are online delivery platforms. In the restaurant case, there are three different platform business models impinging upon their business. In conclusion, our data demonstrates that in services, which accounts for two-thirds of all sectors in the U.S. economy, platforms are intermediating and affecting competitive dynamics, often in multiple ways.

Table 2: Direct versus Indirect Competition from Platform Entrants to Incumbent Firms	
	Incumbent Firm
Transactions directly intermediated by platform entrant, e.g., Etsy connecting buyers and sellers for a commission	Direct Competition
Transaction partners facilitated by platform entrant through improved discovery, providing information that changes the terms of trade, etc.	Indirect Competition
Transactions move online through focal firm's website and/or remain unchanged by platform entrant	No effect on competition

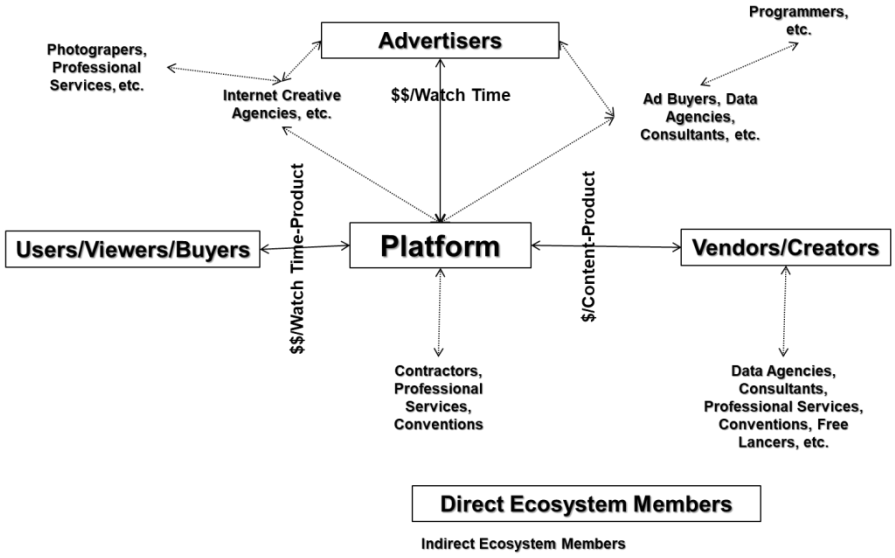
This evidence of platform pervasiveness extends our intuitive understanding by enumerating the business sectors that are experiencing change due to platform business entrants. The deepening influence and power of platforms is evident. It seems likely that their grip on or influence in various traditional business sectors will expand. To illustrate, at the behest of Amazon, Proctor & Gamble reengineered detergent containers to be more easily processed through the logistics chain (Meyersohn, 2018). Thus, the challenging question is not whether platforms are pervasive across the economy, but rather, how to assess how disruptive they are and will be. Our classification of the impact by sectors is an important contribution to measuring the pervasiveness of platform-driven disruption. In the next section, explore how the ecosystems platforms operate and integrate economic activity.

B. The Platform Ecosystem

Once adopted, digital platform ecosystems begin to reorganize economic activity. The power of digital platforms comes from the transactions that the platform enables. For this reason, platforms focus on attracting participants, users, service providers, advertisers, etc., into their

"ecosystems" (Iansiti & Levien, 2004; Jacobides, Cennamo, & Gawer, 2018). The ecosystem participants are crucial because their actions are the ones that the platform converts into income (to see this graphically see **Figure One**). Various platform taxonomies have been introduced, for example, Cennamo (2019) suggests that there are platforms that facilitate transactions, complementary innovations in products or services, and those that provide information. While the ecosystem complementor activities may differ by type of platform, it is the ecosystem complementors' activities that the platform converts into revenue. The core of the Platform Economy is the attraction and integration of the complementors into the platform's ecosystem.

Figure One: Stylized Depiction of a Multi-Sided Platform, Flows of Resources, and Its Ecosystems



The decision to join a platform ecosystem is voluntary, though as the platform grows in size and market share the complementors' decision becomes increasingly "required" to remain commercially viable. A platform's power is predicated upon its ability to direct users or customers to those aiming to sell or provide products and services. Thus, Uber and Lyft's ability to direct those needing a ride to drivers or Airbnb, Expedia, and Booking.com's ability to direct

travelers to hotels, airlines, etc. are what attract providers to the ecosystem and, if the network effects are sufficiently powerful this can lead to a reorganization of the market with the platform becoming the intermediary between customers and the providers that make up the platform's ecosystem.[9] Effectively, for a significant share of their sales hotels and airlines are integrated into the online travel agencies' ecosystems. In a similar way, restaurants are subsumed into the Yelp ecosystem (Luca, 2012).

As an intermediary, the platform has visibility into the on-platform actions of the all participants. This ability to observe actions on the platform enables the platform to structure the ecosystem to elicit behavior that maximizes platform benefits. To illustrate, transaction platforms can raise or lower the fees charged to merchants to maximize its income, while observing their behavior to ensure that, for example, the ecosystem members do not abandon the platform. Similarly, Uber deploys an entire tool kit of strategies and incentives to encourage drivers to drive a bit more, relocate to another area, etc. (Rosenblat & Stark, 2016).

This section has demonstrated that an increasing number of industrial sectors are experiencing digital platforms intermediating aspects of their entire value chain. In some cases, these are ERP systems like Salesforce.com that provide business services such as Salesforce automation. However, in many sectors platforms have been introduced that are becoming new intermediaries in that sector. In some cases, these new intermediaries such as Uber intend to substitute for incumbent service providers through the development of a new business model. In other cases, such as, Airbnb the new entrant organizes alternative services whose impact on the incumbents is more oblique. Additionally, there are platforms such as Booking.com, Yelp, Github, YouTube, and the Amazon Marketplace that receive payments for intermediating

[9] In 2017, it was estimated that online travel agencies (i.e., platforms) accounted for 39% of all online bookings (Kelly, 2017).

between users and suppliers either through direct payments or advertising. Finally, there are some of the mega-platforms such as Facebook, Google Search, or Maps that reorganize and intermediate enormous swathes of the economy.[10]

III. The Foundations of Platform Power

Digital platforms, we argued in section 2, are pervasive throughout the economy, often initiating significant strategic disruptions. The ecosystem graph and the employment pyramid presented in the prior section, show that where the digital platform seed is planted, their growth permeates, often very rapidly, through the fabric of the economy. It spreads both horizontally and vertically. Digital platform firms (DPFs) are often able to extend their positions beyond their initial businesses into other sectors. When successful in an initial domain, the DPF may use the data generated in the core business to expand into other businesses or related aspects of the core business. In some cases, they may entrench or deepen their position in the core business by vertically integrating, often generating capabilities that then allow entrance into other sectors, both related and unrelated to the core business. The flexibility and generativity of digital technologies makes this possible (Zittrain, 2008). These extensions can be relatively mundane economies of scope as, for example, Amazon, which starting in books, began offering other products on its website – literally a matter of adding another catalog and tabs to its website. Somewhat more complex scope-like extensions are digital "products" such as when Google began offering Maps, which required cataloguing enormous amounts of data and providing searchability. Building on the same competencies, Google acquired and expanded YouTube. These expansions can also be less obvious, as, for example, Google is a leader in developing

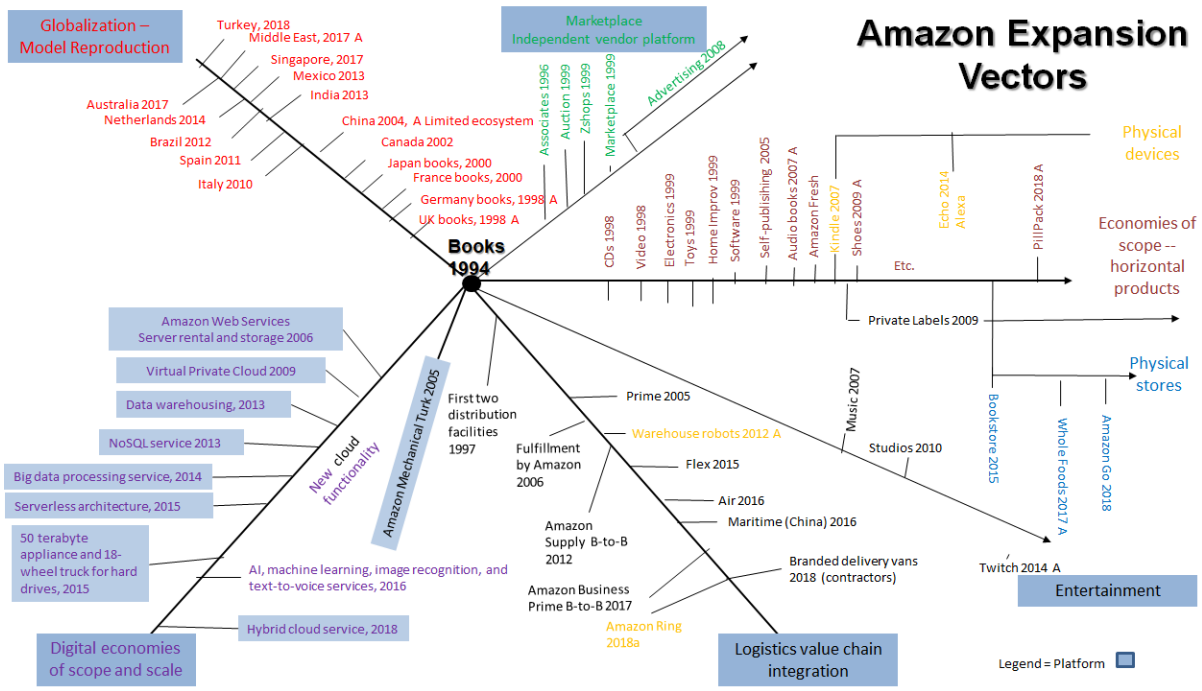
[10] Apple is unusual in that it is one of the most valuable of all the platform firms, but it only affects those in its ecosystem.

autonomous vehicles, which are extremely dependent upon excellent maps and, conversely, would be producing spatial data that can be integrated into maps. Another expansion vector available to DPFs can be to integrate other layers in the software stack. For example, Google has through its introduction of the Android operating system or, as Microsoft in an earlier period, expanded from the operating system into the Windows Office applications. These multifaceted expansions can result in the platform firm acquiring new competitors. For example, Google's entry into maps resulted in it competing with existing, physical and digital, map makers (Dalton, 2015) and, with the autonomous vehicle program, even threatening automobile firms.

In this section, we use the case of Amazon to explore the foundations of platform power. Though obviously not typical, Amazon illustrates horizontal extension and various forms of integration. Understanding Amazon's growth paths provides insight into the difficult policy and regulatory issues that digital platform giants, more generally, create.

A. Amazon Extends: From Website to Platform and Ecosystem

Amazon began, not as a platform in current usage of the term, but rather as website selling books with fulfillment by third parties (Stone, 2013). However, like many other digital firms as **FIGURE TWO** shows, it took advantage of the capacities of its online digital technologies to expand its business. Initially, it expanded horizontally through organic growth and acquisition by adding new product categories. That achieved economies of scope as the initial products added had many similarities with books and could be sold in a similar fashion and supplied by the same logistics firms. In this section, we illustrate how a digital platform firm, Amazon, has expanded on multiple dimensions creating and exploiting synergies, while simultaneously threatening multiple industries.



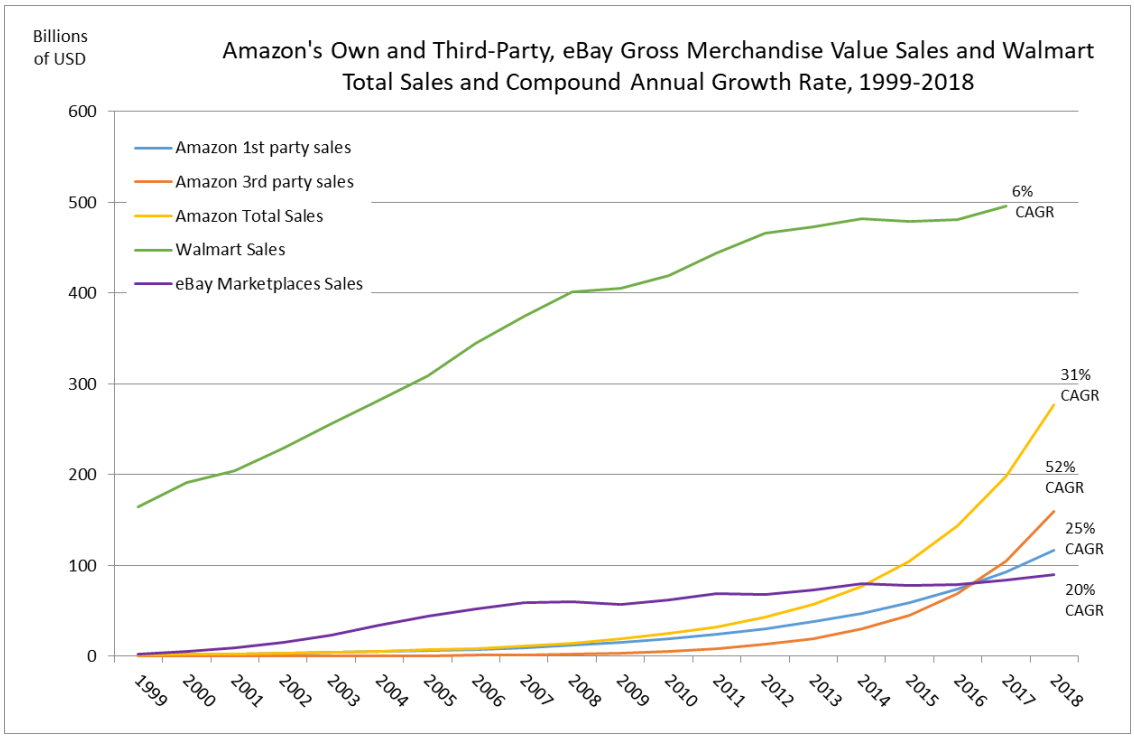
Source: Authors' compilation

In late 1990s, Amazon established three third-party programs. The *first* was the Associates program that began in 1996 and allowed outside websites to link to Amazon. Amazon would receive a referral fee for any purchases the referred person might make. The *second* was an auction site that it established to compete with the larger and faster growing, eBay. The *third* program was shops that allowed merchants to create a virtual storefront on the Amazon platform.

All of these were replaced by the Marketplace in 2002, which listed merchants' goods on the same search page results as Amazon's own products. Marketplace was immediately successful and grew rapidly and as, **Figure Three** shows, third-party merchants now sell more in gross merchandise value than Amazon itself. Even as Amazon's own website has experienced extremely rapid growth, the third-party vendors in the Amazon Marketplace have grown even

more rapidly. In contrast, Walmart's e-commerce growth, on its website and not as a platform, has been far slower. In 2017, of Amazon's $277 billion gross merchandise sales, 58% ($160 billion) came from third-party merchants (Bezos, 2019). The millions of independent vendors result in the Amazon website carrying a greater variety of products and price points than any competitor, thereby contributing to a positive feedback loop attracting more users and thus more merchants. Opening the website to third-parties also means that they can develop new products and find an immediate market through Amazon, but, paradoxically, Amazon, their largest potential competitor can monitor their success – and potentially enter the market with a similar product.

Figure Three: Amazon vs. Walmart



Source: Author's compilation

Amazon's dominance had grown to the point that in 2018, 47% of shopping search began with Amazon, as opposed to 35% with Google. This contrasts with 2015 when Google had 54% and Amazon 46% (Garcia, 2018). Amazon's increasing importance in product search allowed it to introduce on-site advertising, which has become another source of income. Expanding further, in 2012, Amazon introduced a business-to-business sales platform through which manufacturers and wholesalers could sell to retailers and each other. The decision to enter the wholesale market leverages the same data and logistics networks it developed for consumers and, if widely adopted, will allow Amazon increased algorithmic visibility into that part of the supply chain.

a. Expansion in fulfillment

Initially, Amazon contracted third-party vendors to provide fulfillment including warehousing and delivery. In 1997, it established two distribution centers, one in Washington and one on the East Coast and gradually expanded. The introduction in 2005 of Amazon Prime, with its promise of two-day delivery meant that Amazon had to embark on a massive program of creating a rapid delivery infrastructure, even as it was dependent upon USPS, UPS, and FedEx. In 2006, Amazon began offering it third-party merchants use of its fulfillment infrastructure and initiated the integration of fulfillment operations.

As sales grew Amazon was able to negotiate very large volume discounts from its logistics suppliers. That enabled Amazon to offer better terms to its third-party sellers than the third party sellers could get on their own. As it became the dominant online retailer, Amazon also collected ever more data on logistics, i.e. – what would be needed and where. Armed with this data and with its introduction of Amazon Prime, next-day delivery, it expanded its

ownership of the physical assets in the supply chain including warehouses, long-haul trucks, airplanes, and cargo ships to deliver products from Chinese vendors. As delivery and warehouse labor became and an ever greater part of Amazon's wage bill, it also began automating its warehouses. In pursuit of this goal, it purchased warehouse robot maker Kiva Systems.

In 2005-6, Amazon began an enormous investment project to build a new logistics system to be able to provide next-day delivery for the bulk of its customers. It could have confidence the demand would be there because it had massive amounts of very granular data on its customers. Its existing capacity and growing demand, particularly for next-day delivery, driven by Amazon Prime provided it important information suggesting that the demand would be there. Moreover, it would constitute an important competitive advantage against traditional retailers with their brownfield supply chains such as Walmart and competitors such as eBay that do not have a delivery infrastructure.

b. Amazon Web Services: Computing as a Service

To run its operations, Amazon built an enormous cloud computing infrastructure. In 2006, Amazon decided to rent its computing capacity to outside entities and introduced Amazon Web Services (AWS). What Amazon recognized is that computing could be transformed into a commodity that could be rented to other organizations. Amazon would achieve greater efficiencies by more fully utilizing its capacity and receiving what turned out to be the enormous benefits of scale. Initially, AWS just provided computing power, but it rapidly expanded to data storage, software, and other computing related activities as services. AWS proved to be extremely profitable and grew rapidly. An increasing number of organizations are outsourcing significant portions of their computing operations to the giant platform firms, Amazon, Microsoft, and Google that have enormous economies of scale.

c. International Expansion

Amazon also has undertaken a massive international expansion. In many cases, Amazon largely reproduces its U.S. model in other countries. The importance of this international expansion is that the business model is impacting nearly all of the world's largest economies (ex-China and Russia).

d. Riding the Digitization Wave and Expressing Power – Books

Many of the products that Amazon sells have experienced a transformation in form – evolving from physical to digital products. Books are iconic, and offer an example of how Amazon exploited this evolution. The book sales business benefited from and was part of the build out of the Amazon infrastructure – physical logistics and the data centers. As book buying shifted to Amazon, book stores were devastated as Amazon offered greater selection and lower prices (Kotha & Basu, 2011).[11] Further, because all purchases, and also incomplete ones, were recorded, Amazon could collect data on its users so as to analyze and recommend other possible purchases. It rapidly became the largest single purchaser of books and, thus, was able to secure the most favorable prices, thereby driving prices down. When it introduced the Amazon Marketplace in 2002, it resulted in an entire ecosystem of book sellers that could now sell used books to customers everywhere, while allowing vendors to slash prices below suggested retail prices further roiling the market. As an aside, Amazon also allowed customers to post book reviews, thereby disrupting the power of the print media as the dominant book gatekeeper. These

[11] Amazon also did not have to charge local taxes as it did not have a point of presence in most states because it cited its warehouses outside of the most populous states. This was an enormous subsidy.

can be seen as the first-order effects of e-commerce. Bookstores were disrupted, but publishing remained largely unchanged.

Given that the intellectual content of books is words and illustrations, it appeared as though they would be good candidates for digitization and thus inexpensive distribution. In 2001, Amazon established its first e-bookstore, where it offered e-books in PDF or Microsoft reader formats, but they did not sell well (Hoffelder, 2013). In 2003, Amazon introduced its "Search Inside the Book" feature, which helped complete sales, but also forced publishers to digitize their books into a format that Amazon could use (Packer, 2014). In 2005, Amazon launched author self-publishing, which could deliver books either through print-on-demand or electronically. With this, Amazon created another platform for authors to sell directly to readers and effectively grew the market as anyone could publish a book now. After a number of unsuccessful attempts, in 2007, Amazon introduced the Kindle e-book reader, a tablet computer optimized for reading, and it rapidly became the dominant e-book reader, capturing83% of the U.S. market share for e-book downloads in 2017 (Jentetics, 2017).

Amazon's power in the book industry has had a number of impacts, it created an enormous opportunity for authors to self-publish books and for new independent small publishing houses to enter the industry. Amazon also contributed to a drastic reduction in the number of bookstores, the shrinkage of the incumbent publishers, and according to some observers a decrease in authors' earnings (Authors Guild, 2019). Given Amazon's insertion into all aspects of publishing, one commentator discussing independent publishing best described the situation in book publishing this way: "The information asymmetry between Amazon and the rest of the book industry — publishers, brick-and-mortar stores, industry analysts, aspiring writers — means that only the Seattle company has deeply detailed information, down to the

page, on what people want to read. So an industry that's never been particularly data-savvy increasingly works in the dark: Authors lose negotiating power, and publishers lose the ability to compete on pricing or even, on a basic level, to understand what's selling" (Ha, 2018). With its data and algorithms, it is increasingly Amazon that determines the nature of competition, employment patterns, and labor relations in the book business. More importantly, Amazon is the most powerful online retailer; it has power in a large variety of sectors of retail.

e. Generalizing the Amazon Experience — Platform Expansion Paths

For platform firms, success in one sector provides a basis for expansion into adjacent activities. What is different from the physical world, is that the notion of "adjacency", or, adjacent activities, has multiple dimensions, as **Figure Amazon** showed in the case of Amazon.[12] This pattern of expansion into adjacent activities is common to many platforms. In certain respects, it is necessary because in winner-take-all markets, growth, by definition, slows after success, unless a new market or service is introduced. Of course, the initial success provides a secure base for discovery and expansion into an adjacent market. As a simple illustration, Airbnb, the short-term rental booking site, expanded by allowing local guides to offer their services online. More recently, Airbnb introduced a service that allows tenants to rent out their units, while sharing profits with their landlord. Airbnb also provides, or facilitates, the property owner a service that includes guest check-ins and cleaning services. Additionally, Airbnb has ventured into building "condo hotels" that can be listed on Airbnb. Venture capitalists invest in these firms expecting them to experience winner-take-all (or, most) markets and secure monopoly-like profits. Similarly, public stock markets expect sustained, rapid growth.

[12] Henfridsson et al. (2018) have referred to this generativity in digital system as the creation of value paths.

This drive for expansion, horizontal and vertical, has consequences for and origins in the financial structure of the firms. Stock market valuations are fully dependent upon such rapid growth in revenue. For this reason, existing firms must look for the next big thing and either develop a competitive offering in the space or acquire a startup that has already developed a prototype. After purchase, the platform can marshal its resources to support the fledgling firm, which can be done by channeling traffic to the newly acquired website, etc.

These expansion paths are "natural" for platform firms as they leverage their complementary assets, such as, expertise, customers, infrastructure, websites, algorithms, and data to enter other markets (Teece, 1986). In some cases, the lateral expansions are fairly simple in that they need only add another tab on their website (of course, they must build the database of products and ensure that they can fulfill them when purchased). In other cases, such as building a logistics infrastructure can be more expensive and slow. In both cases, as a consequence of success in one sector, the platforms could expand into adjacent sectors.

IV. The Power of Platforms

The extraordinary expansion of capacities and position of digital platform firm translates into exceptional power over other actors in the ecosystem, both firms and labor. Platforms are unusual social constructions, because they operate as intermediaries – in this sense, they resemble markets in that they must attract participants and provide the means for them to transact. Almost invariably a fledgling platform, to be successful, must provide incentives to attract the various "sides" of its platform (Gawer & Cusumano, 2002). As economists have pointed out a platform can provide incentives (also termed subsidies) to any of the platform's sides (e.g., Hagiu & Wright, 2015). So, for example, YouTube provides free access to viewers

and various free tools and a share of any advertising income to video creators. While advertisers are the side of the market that provides the vast majority of the income in return for the ability to serve advertisements to viewers. Of course, YouTube can attempt to monetize other sides as it has by offering a monthly subscription service to viewers. The key to the platform's success is attracting complementors that provide goods or services to the platform's users.

Platform-dependent ecosystems are unusual in that the relationship between the platform and users is based upon uniform contracts that stipulate the conditions for access and use by the users. A candidate platform, as is understood, must not only build the platform, but must also attract participants to the various sides of the platform. Moreover, the relationship between the platform and ecosystem members shifts as the platform attracts greater numbers. Due to network effects with its winner-take-all dynamics, the platform becomes, over time and if successful, less dependent upon individual complementors. Thus, the more successful the platform is, the more asymmetric becomes the situation for complementors, the participants on the platform. Effectively, the more the complementors contribute to the platform's strength the weaker their bargaining position is versus the platform. Therefore, the complementors become ever more vulnerable to rent extraction by the platform or, put differently, a decreasing ability to capture the value they created – this value is captured by the platform owner.

In the initial stages when the platform is introduced, attraction of complementors of requires subsidies to both sides of the platform. Consider the case of Uber: initially Uber offered reasonably high compensation rates to its drivers, while simultaneously offering low rates to users. Taken together, these two facts meant that Uber lost money on substantially every ride sold. In such situations, the fledgling platform firm must secure external sources of capital to defray the cost of the subsidies necessary for building the platform's ecosystem (for a discussion

of the role of venture capital in funding money-losing platforms, see Kenney & Zysman, 2019b).[13] The willingness by investors to fund a money-losing platform is the expectation that a successful firm will exhibit winner-take-all characteristics that will develop monopoly-like control of both users and their goods or services providers. The investor hopes that this will result in positive feedbacks that generate for the platform firm several benefits:

- First, economies of scale or scope will appear, allowing the platform to be extended to similar businesses.
- Second, increasing the number of users will cost less than expansion to service them. For example, while the cost of creating software program may be high, once produced the cost of adding another software program user is extremely low.
- Finally, if competitors are defeated and lock-in has been achieved, the platform has a monopoly/monopsony position and can extract rents due to its position as the irreplaceable intermediary.

Network effects and lock-ins mean that successful platform firms can rapidly grow to enormous size due to the expansion of their ecosystems.

A. Mega-Platforms: Intermediaries and Lock-Ins

Let us consider the ability of the platform to exploit the initial lock-in to expand their reach. With each expansion, they can leverage more data, user engagement, and access to capital, to enter yet other businesses and in the process disrupt or reorganize firms incumbent to that industry.

[13] The role of venture capital in funding the losses that many of these platforms as they attempt to "disrupt" markets and develop quasi-monopoly positions has received minimal attention. The case of Uber has received significant attention (see, for example, Horan, 2017; Doctorow, 2019).

Consider how much power Google has developed. The simplest illustration of its power is captured in the question we posed earlier: "does an organization really exist if it cannot be found through Google Search?" Prior to dismissing this deliberately provocative question as word play, consider the reality of today's business environment. With roughly 85% of all search engine traffic globally (ex-China) on Google, to be found means to discovered by Google. In a profound way, all of the work building websites globally provides value to Google, because it is against these searches that it serves advertisements.

What is the key by which Google creates income? From an office computer one of us conducted a search for the term "Ford pickup truck." The search yielded five pictures of Ford pickup trucks in the advertisement-based "buy box" at the top of the page, and then four advertisements from Ford and various Ford dealerships; all above the organic search result. The same search on a smartphone had three automobiles in the buy box and four advertisements of which three were from Ford-related dealers and one from a car-buying platform, CarMax. In 2018, it was estimated that 88% of automobile shoppers searched online prior to contacting a dealership (Chamberlain, 2018). The unremarkable, but very powerful and lucrative, point of this is that today Google has inserted itself into this aspect of the automobile purchasing experience. The payment to Google is triggered when the searcher clicks through any of these advertisements – effectively, it is paid for lead generation.

At first, this seems unremarkable, but consider the implications. First, the movement of research online means that "local" advertising is far less necessary, thereby switching funds from local newspapers and television stations to the global giant. There is an interesting sub-text here, previously, much of the advertising was purchased by firms like CarMax, Edmunds, etc. through which online research was undertaken – now Google, with its buy box on the top of the page, is

disintermediating them, also. The impact of digitization on dealership employment is difficult to determine, but one would assume that there are fewer car salespersons. Further, within the dealership, as Barley (2015) describes so well, the previous key relationship was between salespersons that met potential buyers on the lot and then, if successful, consummated the sale. This is being replaced by phone and internet exchanges with the visit to the dealership reduced to paperwork and final delivery.

The movement of consumers online pressured organizations to follow them. In the process, older forms of communication such as the Yellow Pages, classified ads etc., declined. The resulting pressure on businesses to create a web presence was remarkable. Consider how Yelp coerced local businesses onto its platform – it purchased a database of 20 million businesses with their basic information, which it posted on its website and then allowed individuals to post reviews of the businesses. As the reviews increased, the businesses found it necessary to provide information to fill out their "Yelp" page, thereby providing free content. As Yelp grew, its ranking algorithm and the accompanying rankings became ever more important for local businesses. As users came to Yelp to read the reviews and check the merchant's ranking, Yelp could run advertising against the search. If the restaurant being searched for did not purchase advertising, then competitors could place their advertisement on the focal restaurant's Yelp page (as "Other Suggestions"). As a further incentive, Yelp's ranking algorithm includes whether the restaurant advertises with Yelp as a positive variable (Winkler, 2015). The power of the Yelp model can be seen, as according to one report, 34% of diners choose restaurants based solely on information offered on peer review websites, while "approximately 53 percent of the coveted 18 to 34-year-old demographic reported that online reviews play an important role into their dining decisions" (Arevalo, 2017). The significance of

this is that the restaurant business, the review platforms, of which, Yelp is the largest (though rapidly being overtaken by Google) are increasingly intermediating the relationship between restaurants and customers and thus can "tax" these owners by encouraging them to buy advertising (Filloon 2018). The decisions of customers to use these online platforms with their rating systems integrates these businesses into the platforms' ecosystems and gives the platform enormous power.

Indeed, now the sectoral platforms are under pressure from the Mega Platforms. The sectoral platforms such as Yelp, TripAdvisor, Booking.com etc. are remarkably powerful in their domains, but they are challenged by competitive offerings from Google's Search, and, more recently, the Google Map function, which is particularly important as usage moves from the personal computer to the smartphone, as Maps are a critical function for finding vendors. To illustrate how digitized travel has become, a Google-funded case study of a consumer planning a trip found that 166 searches were performed with 850 digital travel "touchpoints" of which 24% used maps and another 19% search. Whereas, earlier we asked whether a business that could not be found on Google Search existed, in the smartphone world, a new question can be posed "does a business exist if it cannot be found on Google Maps?"

The quasi-regulatory role of rankings and reviews in disciplining firms has been recognized, as, for example, online ranking, in the eyes of many consumers has replaced or, at least, reduced the importance of government-mandated star systems. In the U.S., Google is introducing "Google Guaranteed," a service where Google undertakes a variety of checks including background and government licensing, but goes even further to include reviews of its Google ad account and publicly available data and video interviews (Google, n.d.). While the inspections are undertaken for a nominal fee, the service provider pays Google by the service

enquiry generated through potential customers referred. Moreover, Google guarantees the service for up to $2,000 – an expression of how confident Google is of its power over the service provider and ability to screen out fraud. With the combination of Google Search, Maps, and Guaranteed, Google is establishing a quasi-regulatory system that, in many respects, not only builds upon governmental systems, but goes beyond both the government and the Better Business Bureau, as it can punish miscreants quickly and without "wasteful" due process. Not only is the Google service more available, it is not only more convenient, but more powerful, as it could ban an offending business, but also an offending customer permanently.

Given Google's dominant market share in search and particularly important for the smartphone, maps, its services are intermediating a remarkably large proportion of consumer interactions with businesses. Today, building a website and ensuring that it can be discovered is a critical management function at all firms. Building a discoverable and usable website is vital. To do this business owners must invest time and money to ensure that their website is discoverable. For an enormous number of organizations, how they are found has changed as internet search has become the universal locator. The firm's website has become its presence to the world and many new types of work like "search engine optimization" and "digital marketing" have appeared to meet this need. While opening new markets and creating new opportunities for firms to access markets, it has also led to increased precarity as businesses become dependent upon platforms where algorithmic or business strategy changes can dramatically increase or decrease the flow of customers. In effect, Google can "tax" the world's businesses so that the can be found. Amazon is well on its way to becoming not only the world's (ex-China) largest retailer/retail platform, but also contributing to the reorganization of many businesses.

V. The Implications of Platform Expansion for Labor

In an economy within which platforms intermediate ever great swathes of economic activity the implications for labor are myriad and complex. For the most part, platform-organized work has been considered in isolation from the changes in the competitive landscape. Research has focused narrowly upon the impacts of platforms such as Uber in reorganizing the taxi market (Parrott & Reich, 2018; Rosenthal 2019), on platform-based contracting for remote work (Huws, 2016), and Airbnb's impact on hotel workers (Zervas et al., 2017). In prior papers, we considered the structure of value creation and work in the platform economy (Kenney & Zysman 2019a; Bearson, Kenney & Zysman, 2019). We argued that any conceptualization of work in the platform economy should consider the remarkably varieties of work and value creation under way. Any conceptualization must encompass the varieties of labor necessary for a platform. It ranges from the highly compensated venture laborers employed by the platforms (Neff, 2012) and the unpaid activities that include searching the net (Google), liking something on Facebook, or providing a review to Yelp (Terranova, 2000). In Kenney and Zysman (2019a) we introduced and in Bearson et al. (2019) extended a comprehensive taxonomy of work and value creation in regards to existing platforms. In these taxonomies and in other analyzes of labor, there was little consideration of how competition by platform firms was also affecting workers not dependent upon a platform or the integration of workers that previously were unaffected into platform ecosystems. This section explores some of these dimensions to illustrate how pervasive the impacts on labor will be due to the platforming of the economy.

A. Platforms Competing Directly with Existing Firms

Job loss due to competition from firms using new technology and business models, or, even within firms as they shift from one technological paradigm to another, has a long history

(Mokyr, Vickers, & Ziebarth, 2015). In the rise of the platform economy, this type of job displacement appears to be increasingly common. Amazon's impact on retail and the logistics supply chain illustrates how platforms are directly affecting competitor firms in a number of ways. As online shopping has increased, it has set in motion what some observers have termed "the retail apocalypse" (Baker, 2019). It has been shown that at the county level, opening an Amazon distribution center has a negative effect on overall employment (Jones & Zipperer, 2018). Presumably, this would be caused by a decrease in retail sales clerks greater that the number of warehouse workers added to complete e-commerce orders. The shifting of work from the retail store also changes the types of workers required and allows for increased automation, as the work process is transferred to a controlled environment, and Amazon, in particular, has emphasized automation (Ackerman, 2019).

Amazon has also been integrating the rest of fulfilment, in particular, warehousing and delivery. As we mentioned previously, Amazon is responsible for approximately 39% of all online sales (Day & Soper, 2019), thus, it has an enormous volume of packages to deliver. While initially it was dependent upon logistics firms such as FedEx, UPS, and the U.S. Postal Service, more recently, it has begun handling its own fulfillment. For example, from 2016 holiday season to March and April of 2019, Amazon went from handling 8% of its final-mile shipments to handling 45% of its own shipments (Pellas, 2019). The integration of the final delivery, however, was not through employing drivers, but rather outsourcing final delivery to large number of "captive" delivery local firms that are entirely dependent upon Amazon (see, for example, O'Donovan & Benzinger, 2019). In this case, Amazon adopted a variant of the Uber, Lyft, Doordash and other platform-mediated, in-person delivery models. In all of these cases, the new

platform-mediated model undermined the traditional labor relations and processes in the particular sector.

In all of these firms, algorithms carefully monitor and identify workers for disciplinary measures. In cases where the workers are independent, the workers need not be given notice. They simply are disqualified and receive no more work. For logistics workers directly employed by Amazon there is careful monitoring and work is allocated by algorithms that not only incessantly increase the work pace, but also determine which workers should be disciplined and terminated (Carey, 2018).[14] As Crystal S. Carey (2018: 2), a Morgan Lewis lawyer retained by Amazon in a National Labor Relations Board case stated, "Amazon's system tracks the rates of each individual associate's productivity and automatically generates any warning or terminations regarding quality or productivity without input from supervisors." Given that Amazon is considered the world's leader in logistics management, it would not be surprising to see its style of labor relations diffuse to competitors.

Amazon's expansion has resulted in a shift from employment in retail to logistics. In the process, Amazon with its contracted delivery drivers is competing and undercutting the more organized USPS, UPS, and FedEx workers. Similarly, authors and publishing firms have experienced massive dislocation, even as more authors than ever can enter the market. Finally, Amazon has created a massive pool of platform-mediated vendors, or, what in another venue termed "platform-dependent entrepreneurs" (Cutolo & Kenney, 2019). These vendors operate in extremely precarious contexts where they are at the mercy of Amazon. According to Amazon's seller policy: "You grant us a royalty-free, non-exclusive, worldwide right and license for the duration of your original and derivative intellectual property rights to use any and all of Your Materials for the

[14] For reports on conditions in Amazon's warehouses and delivery operations, see, for example, Sainato (2019).

Services or other Amazon product or service, and to sublicense the foregoing rights to our Affiliates and operators of Amazon Associated Properties."[15] The impacts upon labor due to digital platforms, thus is complex and can come directly – simple displacement or, more indirectly, by changing the competitive dynamics and thereby resulting in change.

The scope of platforms is remarkable, as is their ability to organize more than just work, but rather value creation. For example, Google's monopoly on Search and browser technology effectively requires the world's websites to make themselves Google-compatible, if they wish to be found. The ability to organize ever more access to customers through platforms is leading to a transformation of workers from employees to "free agents," operating in the platform firm's ecosystem. These free agents, whether Uber drivers, Etsy sellers, Upworkers, or YouTubers, are just as dependent upon the platform as are regular employees. However, in contrast, to employees these platform-dependent entrepreneurs are even more vulnerable as they have none of the rights and protections of employees. The platform economy increases precarity not only for those directly dependent upon a platform for access to income, but also for firms that are dependent upon selling through a platform – an increasingly large part of the business-to-consumer parts of the economy.

VI. Conclusion

The digital platform firms (DPFs) are powerful, pervasive, and penetrating previously unaffected sectors of the economy. The recent onslaught of investigations and enforcement actions in Europe and the U.S. against the platform, giants such as Google, Amazon and Facebook, suggest policy makers in Europe and the U.S. are becoming aware of the power of

[15] For the full Amazon seller policy, see the following link: https://sellercentral.amazon.com/gp/help/external/G1791?language=en_US&ref=efph_G1791_cont_G521.

platforms. A primary focus on the limited set of giants, U.S. principally, should not distract from the pervasive presence of DPFs and the necessity of addressing the general issues raised by their penetration of increasing portions of the economy.

Within their ecosystems, platforms are de facto private regulators, setting the rules of markets and often of social life as well. In some respects, they are more powerful regulators than governments themselves. For example, in the hotel booking realm, consumers are more likely to make decisions based on the algorithmic rankings and reviews than on the basis of the government star system. That raises the question of what public oversight of these private firms might be required. Indeed, what is the proper role of the state as the Platform Economy matures?

We have shown how increasingly large parts of the economy are falling under the sway of the platforms. Effectively, all websites today are designed to be found by the Google Search engine – what cannot be found does not exist. In the mobile world, maps (specifically Google Maps) determines what can be found. For a retailer, a presence on Amazon is necessary to be relevant. While we are still early in the era of platforms, today, with our admittedly crude measurements, it is clear that both inter-firm competition and labor markets are being reorganized by platform firms. Indeed, in many service-providing sectors, we find DPFs as intermediaries of various types. Rightfully, much of the attention is devoted to new labor intermediaries such as Uber, Lyft, Upwork, and AMT. However, an even larger impact may be the way online retail through Amazon, eBay, and Etsy is moving employment from the retail shop floor to warehouses and home delivery couriers. While temp work and the contraction of those employed in a stable 40-hour week was already underway, gig and contract labor markets have moved on line with firms like Upwork and Uber. For professional workers, LinkedIn has become the way employment mobility is being organized – the headhunter now prowls LinkedIn.

Platform power is derived from the platform's concomitants ecosystem. Without the ecosystem of complementors, a platform firm is nothing more than a "product" firm. It can be powerful, but it does not have the outsize power that comes from the thousands and even millions of firms and individuals whose activities are coordinated and regulated through the platform. Consider again, the power that accrues to Amazon through having 2 million active sellers, or that Google derives from cataloguing and ranking well over a billion websites – all of which want to be catalogued. Similarly, Booking.com claims to book over 1.5 million rooms per day – effectively, hotels have been integrated into Booking.com and its two competitors' ecosystems. It is essential to understand the size and dynamics of these ecosystems to see the broader economic significance of the DPFs. To inform policy, we require a better understanding of how platforms attract complementors into their ecosystems and how they then change the terms of integration as the complementors become locked-in to the ecosystem.

The power of platforms lies in how they can orchestrate the activities of participants, and largely determine the operation of the far more numerous complementors in the ecosystem. We explored both the foundations of platform power and its expression. A crucial implication is that the 19th and even 20th century definitions and measures of market and social power may not be adequate. For example, classic competition policy measures of market share have significant limits in the presence of platforms. First, platforms spread quickly across markets, as we have seen with the case of Amazon. One of their greatest strengths is to leverage their complementary assets such as knowledge of customers, ability to funnel customer traffic, cross-subsidization, and economies of scale and scope to enter new markets.

One of the key levers of power that the platform wields, in respect to it the complementors in its ecosystem, are enshrined in the "terms and conditions" that all actors that

will transact on the platform must agree to prior to using the platform. These contracts specify the terms of usage for the participants. The most important clause in these contracts is that the platform has the right to unilaterally change the contract at its discretion. This contractual right transcends specific questions or grievances such as changes in the firm's "placement" in an Amazon, Google Search or Booking.com list, whether a platform such as Amazon can use a merchant's data to develop its white label products to enter that markets, or whether buyers and sellers can interact directly and thus disintermediate the platform. The terms and conditions are, in effect, private regulatory systems that exercise power. Given the reach and pervasiveness of these mega-platforms such as Google Search, Maps, Amazon, Facebook, and Apple (in its ecosystem), the establishment of an economy increasingly organized by platforms raises fundamental questions of what entities should have what type of power. What is appropriate power in the market and society? Declaring principles for a digital economy is not sufficient; as emphasized by Lessig (1999), those principles have to be expressed in code and in contract.

Digital platform businesses have become pervasive throughout the economy. They are present in diverse sectors, often not only relevant to the character of competition as with food delivery services, but often in the case of the mega platforms shaping the terms of competition and, indeed, the marketplace. In many sectors, these platforms have become powerful private regulators shaping the rules of the market and society within their ecosystems. We have shown that the Platform Economy is increasingly defining economic and social power, and thus directly confronts the role of the state and public power.

APPENDIX ONE

	Table 1: Dominant Platform Firms		
Platform Firm	**Platform Firm Model**	**Revenue, 2018/9 ($ million)**	**Employment 2018**
Apple	Innovation	265,595	132,000
Amazon	Transaction	232,887	647,500
Google	Information/Innovation	136,819	98,771
Microsoft	Innovation/Information	125,843	144,100
Facebook	Transaction	55,838	35,587
PayPal	Transaction	15,451	21,800
Booking	Transaction	14,527	24500
Uber	Transaction	11,270	22,263
Expedia Group	Transaction	11,200	24,500
Salesforce	Innovation	10,480	29,000
YouTube (Google)	Innovation	n/a	n/a
Valve Steam	Transaction	4,300	360
LinkedIn (Microsoft)	Information	3,073	9,372
Twitter	Information	3,042	3,920
Match.com	Transaction	1,730	1,500
Airbnb	Transaction	1,700	3,100
TripAdvisor	Transaction	1,615	3,366
Zillow	Information/Transaction	1,334	4,336
Pinterest	Transaction	1,120	1,600
GrubHub	Transaction	1,007	2,722
Lending Club	Transaction	531	1,768
AutoTrader	Information/Transaction	424	824

Snap	Transaction	404	2,884
Upwork	Transaction	253	430
Care.com	Transaction	192	678
Coursera	Transaction/Innovation	n/a	280
Instagram (Facebook)	Innovation/Information	Acquired	n/a
Instacart	Transaction	n/a	n/a
Github (Microsoft)	Innovation	Acquired	n/a
TaskRabbit (Ikea)	Transaction	Acquired	n/a
WhatsApp (Facebook)	Transaction	Acquired	50

Note: Data from SEC 10-K statements in the case of public companies. Other data from company press releases or Wikipedia. Revenue refers to gross revenue in 2018 or latest year available. In the case of PayPal, revenue refers to net revenue. Employment data refers to full-time equivalents and part-time employment depending on the firm. LinkedIn data is as of 2015. Data is not available for companies that are not publicly traded or acquired (in the case of TaskRabbit). According to Michael Cusumano, a transaction platform "serves as an intermediary for direct exchange or transactions, subject to network effects" an innovation platform "serves as a technological foundation upon which other firms develop complementary innovations." An information platform is one that provides information in exchange for advertising revenue.

REFERENCES

Ackerman, E. (2019, June 5). Amazon uses 800 robots to run this warehouse. *IEEE Spectrum*. Retrieved from https://spectrum.ieee.org/automaton/robotics/industrial-robots/amazon-introduces-two-new-warehouse-robots

Arevalo, M. (2017, April 26). The impact of reviews on the restaurant market. *Modern Restaurant Management*. Retrieved fromhttps://www.modernrestaurantmanagement.com/the-impact-of-reviews-on-the-restaurant-market-infographic/

Authors Guild. (2019, January 5). Authors Guild survey shows drastic 42 percent decline in authors earnings in last decade. *The Authors Guild.* Retrieved from https://www.authorsguild.org/industry-advocacy/authors-guild-survey-shows-drastic-42-percent-decline-in-authors-earnings-in-last-decade/

Baker, S. (2019, April 17). The retail apocalypse has claimed 6,000 US stores in 2019. *Business Insider.* Retrieved from https://www.businessinsider.com/retail-apocalypse-start-of-2019-more-store-closures-all-of-2018-2019-4

Barley, S. (2015). Why the internet makes buying a car less loathsome: How technologies change role relations. *Academy of Management Discoveries*, *1*(1), 5-35.

Barrett, M., Oborn, E., & Orlikowski, W. (2016). Creating value in online communities: The sociomaterial configuring of strategy, platform, and stakeholder engagement. *Information Systems Research*, *27*(4), 704-723.

Bearson, D., Kenney, M., & Zysman, J. (2019). Labor in the platform economy: New work created, old work reorganized and value creation reconfigured. *BRIE Working Paper 2019-2.*

Berger, T., Chen, C., & Frey, C. B. (2018). Drivers of disruption? Estimating the Uber effect. *European Economic Review*, *110*, 197-210.

Bezos, J. 2019. *2018 letter to shareholders.* The Amazon Blog, Day One. Retrieved from https://blog.aboutamazon.com/company-news/2018-letter-to-shareholders

Brynjolfsson, E., Collis, A., Diewert, W., Eggers, F., & Fox, K. (2019). *GDP-B: Accounting for the value of new and free goods in the digital economy*. (NBER Working Paper No. 25695).

Cabral, L., Peitz, M., & Wright, J. (2019). Introduction to special issue on platforms. *Journal of Economics & Management Strategy*, *28*(1), 3-4.

Caillaud B, Jullien B. (2003). Chicken-and-egg: competition among intermediation service providers. *RAND Journal of Economics, 34*(2), 309–328.

Carey, C. S. (2018). Re: Case No. 05-CA-224856, Letter to Barbara Elizabeth Duvall, Field Attorney, National Labor Relations Board, Region 5. (Authors have PDF Copy)

Castells, M. (2013). *Communication Power (2nd ed.)*. New York, NY: Oxford University Press.

Cennamo, C. (2019). Competing in digital markets: A platform-based perspective. Forthcoming in *Academy of Management Perspectives*.

Chamberlain, L. (2018, March 27). 86 percent of car shoppers conduct research online before visiting a dealership. *GeoMarketing.* Retrieved from https://geomarketing.com/86-percent-of-car-shoppers-do-research-online-before-visiting-a-dealership

Cho, D., Smith, M. D., & Zentner, A. (2016). Internet adoption and the survival of print newspapers: A country-level examination. *Information Economics and Policy*, *37*(C), 13-19.

Cusumano, M. A., Yoffie, D. B., & Gawer, A. (2019). *The business of platforms: Strategy in the age of digital competition, innovation, and power*. New York, NY: HarperCollins Publishers.

Cutolo, D.& Kenney, M. (2019). *The emergence of platform-dependent entrepreneurs: Power asymmetries, risk, and uncertainty*. (BRIE Working Paper 2019-3). Retrieved from https://brie.berkeley.edu/recent-publications/current-publications.

Dalton, C. (2015). For fun and profit: the limits and possibilities of Google-Maps-based geoweb applications. *Environment and Planning A: Economy and Space*, *47*(5), 1029-1046.

Day, M. & Soper, S. (2019, June 13). Amazon U.S. online market share estimate cut to 38% from 47%. *Bloomberg.* Retrieved from *https://www.bloomberg.com/news/articles/2019-06-13/emarketer-cuts-estimate-of-amazon-s-u-s-online-market-share* Doctorow, C. (2019, May 30). Now that Uber and Lyft are public, their inevitable financial collapse is much clearer. *BoingBoing*. Retrieved fromhttps://boingboing.net/2019/05/30/short-positions-ahoy.html

Eisenmann, T., Parker, G., & Van Alstyne, M. (2011). Platform envelopment. *Strategic Management Journal*, *32*(12), 1270-1285.

Eisenmann, T., Parker, G., & Van Alstyne, M. (2006). Strategies for two sided markets. *Harvard Business Review 84*(10), 92-101.

Eurofound. (2018). *Employment and working conditions of selected types of platform work.* Luxembourg: Publications Office of the European Union.

Filloon, W. (2018, November 16). Yelp's heyday is over. *Eater*. Retrieved from https://www.eater.com/2018/11/16/18094979/yelp-stock-plunge-future-viability-competition-google-instagram-twitter

Forde, C., Stuart, M., Joyce, S., Oliver, L., Valizade, D., Alberti, G., . . . Carson, C. (2017). *The social protection of workers in the platform economy.* University of Leeds, European Parliament, Committee on Employment and Social Affairs.

Frenken, K. & Schor, J. (2017). Putting the sharing economy into perspective. *Environmental Innovation and Societal Transitions*, *23*, 3-10.

Frenken, K., Vaskelainen, T., Fünfschilling, L., & Piscicelli, L. (2018). An institutional logics perspective on the gig economy. S*ocArXiv Papers. Retrieved from* https://osf.io/preprints/socarxiv/uqn9v/

Fumagalli, A., Lucarelli, S., Musolino, E., & Rocchi, G. (2018). Digital labor in the platform economy: The case of Facebook. Sustainability, MDPI, Open Access Journal, 10(6), 1-16.

Furman, J. & Seamans, R. (2019) AI and the economy. In J. Lerner & S. Stern (Eds.) Innovation Policy and the Economy (Vol. 19) (pp. 161-191). Cambridge, MA: National Bureau of Economic Research.

Garcia, K. (2018, September 7). More Product Searches Start on Amazon. *eMarketer*. Retrieved from https://www.emarketer.com/content/more-product-searches-start-on-amazon

Gawer, A., & Cusumano, M. A. (2002). *Platform Leadership: How Intel, Microsoft, and Cisco Drive Industry Innovation*. Boston, MA: Harvard Business School Press.

Google (n.d.). *Local services help*. Retrieved from https://support.google.com/localservices/answer/6230381

Graham, M., Hjorth, I., & Lehdonvirta, V. (2017). Digital labour and development: Impacts of global digital labour platforms and the gig economy on worker livelihoods. *Transfer: European Review of Labour and Research*, *23*(2), 135-162.

Ha, T.-H. (2018, May 13). Are ebooks dying or thriving? The answer is yes. *Quartz.* Retrieved from https://qz.com/1240924/are-ebooks-dying-or-thriving-the-answer-is-yes/

Hagiu, A., & Wright, J. (2015). Multi-sided platforms. *International Journal of Industrial Organization, 43*(C), 162-174.

Hall, J. & Krueger, A. (2018). An analysis of the labor market for Uber's driver-partners in the United States. *ILR Review, 71*(3), 705-732.

Henfridsson, O., Nandhakumar, J., Scarbrough, H., Panourgias, N., (2018). Recombination in the open-ended value landscape of digital innovation. *Information and Organization, 28*(2), 89–100.

Hoffelder, N. (2013, November 14). Amazon's first ebookstore launched 13 years ago today. *The Digital Reader*. Retrieved from https://the-digital-reader.com/2013/11/14/amazon-ebooks-14-november-2000/

Horan, H. (2017). Will the growth of Uber increase economic welfare? *Transportation Law Journal 44*, 33-105.

Howcroft, D. & Bergvall-Våreborn, B. (2019). A typology of crowdwork platforms. *Work, Employment and Society, 33*(1), 21-38.

Huws, U. (2016). Platform labour: Sharing economy or virtual wild west. *Journal for a Progressive Economy*, *1,* 24-27.

Huws, U., Spencer, N., & Syrdal, D. (2018). Online, on call: The spread of digitally organized just□in□time working and its implications for standard employment models. *New Technology, Work and Employment*, *33*(2), 113-129.

Iansiti, M., & Levien, R. (2004). *The keystone advantage: what the new dynamics of business ecosystems mean for strategy, innovation, and sustainability*. Boston, MA: Harvard Business School Press.

Jacobides, M., Cennamo, C., & Gawer, A. (2018). Towards a theory of ecosystems. *Strategic Management Journal, 39*(8), 2255-2276.

Jentetics, K. (2017, October 25). Amazon Ebook Market Share 2017 – is it big enough? *PublishDrive.* Retrieved from https://blog.publishdrive.com/amazon-ebook-market-share/

Jones, J and Zipperer, B. (2018, February 1). Unfulfilled promises. *Economic Policy Institute.* Retrieved from https://www.epi.org/publication/unfulfilled-promises-amazon-warehouses-do-not-generate-broad-based-employment-growth/

Kalleberg, A. & Dunn, M. (2016). Good jobs, bad jobs in the gig economy. *Perspectives on Work, 20*(2), 10-14.

Katz M. & Shapiro C. (1994). Systems competition and network effects. *Journal of Economic Perspectives, 8*(2), 93–115.

Kelly, M. (2017, February 24). OTAs increase market share at supplier's expense. *TravelTrends.* https://www.traveltrends.biz/ttn555-otas-increase-market-share-at-suppliers-expense/

Kenney, M. & Zysman J. (2016). The rise of the platform economy. *Issues in Science and Technology, 32*(3), 61-69.

Kenney, M. & Zysman, J. (2019a)). Work and value creation in the platform economy. Forthcoming in P. Kovalainen & S. Vallas (Eds.), *Research in the sociology of work* (pp. 13-41). Emerald Publishing Limited.

Kenney, M. & Zysman, J. (2019b). Unicorns, Cheshire cats, and the new dilemmas of entrepreneurial finance. *Venture Capital: An International Journal of Entrepreneurial Finance, 21*(1), 35-50.

Kita, K. & Kidziński, L. (2019). Google Street View image of a house predicts car accident risk of its resident. *ArXiv*. Retrieved from https://arxiv.org/abs/1904.05270

Kotha, S., & Basu, S. (2011). Amazon and eBay: Online retailers as market makers. In G. G. Hamilton, B. Senauer, and M. Petrovic (Eds.) *The market makers: How retailers are reshaping the global economy*. (pp. 155-177). Oxford, U.K.: University Press.

Lessig, L. (1999). *Code: And other laws of cyberspace*. New York, NY: Basic Books.

Luca, M. (2011). *Reviews, reputation, and revenue: The case of Yelp.com*. (Harvard Business School, Working Paper 12-016). Retrieved from https://www.hbs.edu/faculty/Pages/item.aspx?num=41233

Manyika, J., Lund, S., Bughin, J., Robinson, K., Mischke, J., & Mahajan, D. (2016). *Independent work: Choice, necessity, and the gig economy.* San Francisco, CA: McKinsey Global Institute.

Marketplace. (2019, June 19). *The CEO of Lands' End knows exactly who his customers are.* Retrieved from https://www.marketplace.org/shows/corner-office-from-marketplace/lands-end-ceo-knows-exactly-who-his-customers-are/

Marketpulse. (2019). *Number of sellers on Amazon Marketplace*. Retrieved from https://www.marketplacepulse.com/amazon/number-of-sellers

Meyersohn, N. (2018). *Tide in a box is coming to Amazon for easier shipping.* CNN Business. Retrieved from https://www.cnn.com/2018/11/10/business/tide-laundry-detergent-procter-and-gamble/index.html

Mokyr, J., Vickers, C., & Ziebarth, N. (2015). The history of technological anxiety and the future of economic growth: Is this time different? *Journal of Economic Perspectives*, *29*(3), 31-50.

Neff, G. (2012). *Venture labor: Work and the burden of risk in innovative industries*. Cambridge, MA: MIT Press.

O'Donovan, C. & Bensinger, K. (2019, August 31). Amazon's next-day delivery system has brought chaos and carnage to America's streets – but the world's biggest retailer has a system to escape the blame. *BuzzFeed*. Retrieved from https://www.buzzfeednews.com/article/carolineodonovan/amazon-next-day-delivery-deaths

Packer, G. (2014, February 9). Cheap words. *The New Yorker*. Retrieved from https://www.newyorker.com/magazine/2014/02/17/cheap-words.

Parker, G., Van Alstyne, M., & Choudary, S. P. (2016). *Platform revolution: How networked markets are transforming the economy and how to make them work for you*. New York, NY: W.W. Norton & Company.

Parrott, J., & Reich, M. (2018). An earnings standard for New York City's app-based drivers: Economic analysis and policy assessment. *Center for New York City Affairs, The New School.* Retrieved from http://www.centernyc.org/

Pellas, A. (2019, July 2). Amazon Logistics has arrived . . . early. *Rakuten Intelligence*. Retrieved from https://www.rakutenintelligence.com/blog/2019/amazon-logistics-has-arrived-early

Popiel, P. (2017) 'Boundaryless" in the creative economy: Assessing freelancing on Upwork. *Critical Studies in Media Communications, 34*(3), 220-233.

Rahman, K. S., & Thelen, K. (2019). The rise of the platform business model and the transformation of twenty-first-century capitalism. *Politics & Society, 47*(2), 177-204.

Riso, Sara. (2019). *Mapping the contours of the platform economy*. (Eurofound Working Paper No. WPEF19060).

Rochet, J.-C. & Tirole, J. (2003). Platform competition in two-sided markets. *Journal of the European Economic Association*, *1*(4), 990-1029.

Rosenblat, A., & Stark, L. (2016). Algorithmic labor and information asymmetries: A case study of Uber's drivers. *International Journal of Communication*, *10*, 3758–3784.

Rosenthal, B. (2019, May 19). 'They were conned': How reckless loans devastated a generation of taxi drivers. *The New York Times*. Retrieved fromhttps://www.nytimes.com/2019/05/19/nyregion/nyc-taxis-medallions-suicides.html

Sainato, M. (2019, June 14). The ruthless reality of Amazon's one-day shipping. *Gizmodo*. Retrieved from https://gizmodo.com/the-ruthless-reality-of-amazons-one-day-shipping-1835513901

Schor, J. (2016). Debating the sharing economy. *Journal of Self-Governance and Management Economics*, *4*(3), 7-22.

Shapiro, C., & Varian, H. (1998). Information rules: A strategic guide. *Boston, MA: Harvard Business School Press*.

Srnicek, N. (2017). *Platform Capitalism*. Cambridge, U.K.: Polity Press.

Stone, B. (2013). *The everything store: Jeff Bezos and the age of Amazon*. Boston, MA: Little, Brown and Company.

Sundararajan, A. (2016). *The sharing economy: The end of employment and the rise of crowd-based capitalism*. Cambridge, MA: The MIT Press.

Teece, D. (1986). Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. *Research Policy, 15*(6), 285-305.

Terranova, T. (2000). Free labor: Producing culture for the digital economy. *Social Text*, *18*(2), 33-58.

Ticona, J., Mateescu, A., & Rosenblat, A. (2018). Beyond disruption: How tech shapes labor across domestic work & ridehailing. *Data & Society.* Retrieved from https://datasociety.net/output/beyond-disruption/.

Tiwana, A., Konsynski, B., & Bush, A. (2010). Research commentary—platform evolution: Coevolution of platform architecture, governance, and environmental dynamics. *Information Systems Research*, *21*(4), 675-687.

U.S. Department of Commerce. (2019). *Quarterly retail e-commerce sales, 2nd Quarter 2019*. (Report No. CB19-117). Washington, D.C.: U.S. Census Bureau News.

Van Dijck, J. (2013). *The culture of connectivity: A critical history of social media*. New York, NY: Oxford University Press.

Winkler, R. 2015. Yelp Says FTC won't act on complaints about its reviews. *Wall Street Journal* (January 6) https://blogs.wsj.com/digits/2015/01/06/yelp-says-ftc-wont-act-on-complaints-about-its-reviews/

Zervas, G., Proserpio, D., & Byers, J. W. (2017). The rise of the sharing economy: Estimating the impact of Airbnb on the hotel industry. *Journal of Marketing Research*, *54*(5), 687-705.

Zittrain, J. (2008). *The future of the internet—and how to stop it*. New Haven, CT: Yale University Press.