

Article

The platform economy matures: measuring pervasiveness and exploring power

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Abstract

Online platforms are pervasive and powerful in today's economy. We explore the increased centrality of platforms in two ways. First, we measure the extent to which platforms are insinuating themselves into the economy. We accomplish this by analyzing the presence of platforms as intermediating organizations across all US service industries at the six-digit North American Industry Classification System code level. Our results show that 70% of service industries, representing over 5.2 million establishments, are potentially affected by one or more platforms. Secondly, we undertake a detailed firm-level case study of the mega-platform, Amazon, which demonstrates the ways that the aforementioned macro-level data is expressed by a single platform firm. This case study shows that Amazon's growth trajectory has resulted in it entering and transforming existing industries and sectors. We conclude by reflecting upon the limitations and implications for future research.

Key words: platform economy, industrial organization, Amazon, digitization, technology, governance

JEL classification: J0, O1, O3

1. Introduction

Online platform firms have insinuated themselves into ever more sectors of the economy and accumulated power as critical intermediaries (Kenney and Zysman, 2016; Srnicek, 2016; Van Dijck *et al.*, 2018; Zuboff, 2019).¹ Initially, many social scientists believed that a new

1 In this article, we define *platforms* as online places or infrastructures (i.e. websites and mobile apps) designed specifically to facilitate transactions and other valued exchanges of goods, information and opinion (Gawer, 2014) These can be considered exchange platforms, and are fundamentally

era of “sharing” was dawning and that platforms would decentralize power, allowing individuals and small businesses to compete with traditional firms (Einav *et al.*, 2016; Frenken and Schor, 2017; Schor, 2016; Sundararajan, 2013, 2016). Others asserted that platforms would lead to greater economic democracy (Benkler, 2006). Yet, nearly two decades after the emergence of online digital platforms, we argue that platforms have done the opposite—platforms are not only creating new markets but also reorganizing ever greater numbers of more traditional industrial sectors so as to extract value from participants (Cutolo *et al.*, 2021; Cutolo and Kenney, 2021). In other words, their reach and sway over the economy is becoming ever greater.

The pervasiveness and power of platforms is remarkable. Facebook, WhatsApp, Google Search, the Chrome browser, Android, YouTube, Google Maps, and Amazon exceed 2 billion monthly active users. In December of 2020, five platform firms—Microsoft, Apple, Amazon, Google’s parent Alphabet, and Facebook—accounted for 22% of S&P 500 market capitalization (Wigglesworth, 2020). Along with two Chinese platforms—Alibaba and Tencent—the top seven most valuable publicly traded firms in the world are platform firms (on Chinese firms, see Jia and Kenney, 2021).² Moreover, due to the Covid-19 crisis of 2020, these platform firms increased their value while most other firms saw their value decline. To paraphrase Marc Andreessen, founder of Netscape and prominent venture capitalist, platforms are consuming the world (Parker *et al.*, 2016).

Our purpose in this article is to explicate the expansion of platforms and their power. In Section 2, previous research on the spread of platforms and their sources of power is considered. Section 3 develops an original framework to descriptively measure the pervasiveness of platforms across the US economy using North American Industry Classification System (NAICS) codes. This section demonstrates that platform firms are insinuating themselves into ever more industries, and provides the first comprehensive, quantitative evidence for the extent to which platforms are intermediating business activities in US service industries. To further this discussion, the distinction between the direct and indirect influence of platforms on industries is introduced. The results show that 70% of service industries, representing over 5.2 million establishments, are being affected directly or indirectly by one or more platforms.³ In Section 4, a detailed case study of Amazon’s expansion, identifying eight expansion vectors, shows how Amazon not only diversified, but more importantly, leveraged its

different from product platforms, where complementors create value by creatively drawing on certain fixed core elements (e.g. industry standards; Baldwin, 2019). A platform is based upon the formation of an *ecosystem* when the platform attracts a myriad of other contributors (Jacobides *et al.*, 2018). A platform acts as an *intermediary* by facilitating transactions for contributors within the ecosystem. We define a *mega-platform firm* as a firm that operates multiple platforms across industries, whereas a *sectoral platform firm* is a firm that operates in a single industry and, most often, a single platform.

- 2 The Saudi Arabian government monopoly, Aramco, is the most valuable firm in the world. However, it remains 98% owned by the Saudi government and thus is only marginally public.
- 3 Establishments are defined as single physical locations at which business is conducted or services or industrial operations are performed. In 2017, there were 7 860 674 establishments in USA. In the services sector, defined as NAICS (44–81), there were 6 368 619 establishments in 2017 (Census Bureau, 2020d).

assets in one industry to enter yet other industries.⁴ Precisely because Amazon so clearly displays the diverse mechanisms by which platforms spread and entrench themselves, it is a useful case to reflect on the platform phenomena. Section 5 discusses the implications of the increasingly pervasive and powerful role of platforms in reorganizing industries and reflects upon paths for future research.

2. Previous research on platform pervasiveness and power

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 (Parker and Van Alstyne, 2005). At the time, few understood how powerful platforms would become as a way of organizing markets and industries. Platform adoption was accelerated by technical developments such as the introduction of the smartphone, which connected yet more people to the Internet and freed the Internet and users from the Microsoft-controlled personal computer. The result of moving social and economic activity online was that it could be intermediated by platforms (Van Dijck, 2013; Van Dijck *et al.*, 2018). Not only did online activity become embedded in a web of platforms, but also, for non-platform businesses, platforms increasingly shaped how customers found and interacted with them, how they hired, handled paperwork (information and data), connected with customers, and shipped products. This led Koen Frenken *et al.* (2018) to argue that platform firms combine the institutional logics of markets, corporations, and the state into a single organizational form.

There have been various studies that identify which industries might be susceptible to platformization. As is the case with nearly every study, platform researchers, such as Cusumano *et al.* (2019), list the various platforms and conclude that many industries are or will be affected. However, they do not undertake exhaustive analysis of the industries that have been impacted. In a general sense, Parker *et al.* (2016) suggest that in traditional industries, firms with internally-owned resources are increasingly being outcompeted by platforms' ability to create new infrastructures to coordinate buyers and sellers. Similarly, Rahman and Thelen (2019, p. 4) assert that the platform strategy represents an aspiration to become the foundational infrastructure for a sector, or multiple sectors.

There have been numerous qualitative and quantitative studies attempting to measure the effects of platforms in the economy. This research has focused almost exclusively on the few sectors where platform presence is most visible, such as transportation, accommodation, professional services, publishing, advertising and finance (OECD, 2019, p. 43; Petropoulos *et al.*, 2019, pp. 84–86). For example, numerous studies attempt to measure the effect of ridesharing firms such as Uber and Lyft on the taxi industry (see, for example, Parrott and Reich, 2018). In another study, Pan and Qiu (2018) found that ridesharing firms depressed mass transit usage. Further, the business press suggests that ridesharing firms also impacted the rental car market (Reints, 2019). Thus, in the case of ridesharing platforms, three

4 This case study extends the work of Aversa *et al.* (2020) by providing a granular analysis that explores Amazon's expansion strategies, which has led to it becoming one of the most powerful firms in the world, and generally, explores issues of platform power and expansion (Tiwana *et al.*, 2010).

different industries were impacted: taxis, mass transit and car rentals.⁵ Research has shown that Airbnb has impacted, not only, the hotel industry (Zervas *et al.*, 2017; Farronato and Fradkin, 2018), but also long-term rental availability in a number of cities (see, for example, Wachsmuth and Weisler, 2018 and Barron *et al.*, 2019). In the restaurant industry, researchers have found that Yelp ratings are important for revenue (Luca, 2016).⁶ The impact of Amazon on retail has been remarked upon in the business press and by policy-makers, but remarkably few academic researchers (Khan, 2016; LaVecchia and Mitchell, 2016). Finally, there has been an outpouring of studies of online gig labor contracting platforms (e.g. Kässi and Lehdonvirta, 2018). These studies illustrate that a wide variety of industrial sectors have been affected by the presence of platforms.⁷ However, as studies of single firms, they cannot illuminate the larger picture and thus the implications for the entire economy (Bearson *et al.*, 2020).

During the last two decades, in one industrial sector after another, platforms have become intermediaries by leveraging the strength of network effects, winner-take-most characteristics of their markets and modular character of many digital technologies that afford generativity (Eaton *et al.*, 2011). Additionally, platforms can leverage the data they capture from their users to expand into new, adjacent industries or deepen the services they offer in particular industries (Eisenmann *et al.*, 2011; Parker *et al.*, 2016; Gawer, 2020). This complicates analysis because when new services are offered in other industries, they are classified as belonging to a different industrial code. As we will show in the case of Amazon, digital technologies were used to create new services or identify new growth opportunities, thereby resulting in unexpected expansion paths (Henfridsson *et al.*, 2018).

Platforms generate value, not only by their own activities, but also, and perhaps more importantly, by the vast ecosystems that emerge around them (Parker *et al.*, 2016; Cusumano *et al.*, 2019). For the larger platforms, these ecosystems can be quite complex and contain a diversity of actors, depending upon the users that the platform attracts.⁸ It is necessary to understand both the structure of the platform firms and the ecosystems of value creation that coalesce on the various sides of the platform (Rochet and Tirole, 2003).

Platform power derives, as the Amazon case will demonstrate, from these value creating ecosystems. The expansion and centrality of platform firms translates into exceptional power over other actors in the ecosystem. Without the ecosystem of complementors, a platform firm is nothing more than a 'product' firm. Such firms would be powerful but would not have the enormous power that comes from the thousands and even millions of firms and individuals whose activities are coordinated and directed through it. Consider again the power that accrues to Amazon by having 2 million active sellers, or that Google derives from cataloging and ranking well over a billion websites—all of which want to be cataloged. 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

5 When we refer to an industry, we are using the North American Industry Classification System (NAICS). Taxis are in NAICS Code 48531, mass transit is in NAICS Code 48511, car rentals are in NAICS Code 532111.

6 Hotels are in NAICS Code 721110 and Restaurants are in NAICS Code 722511.

7 For a study of platforms' effect on market organization in the cases of Airbnb and Lyft, see Kirchner and Schuessler (2019).

8 For an in-depth discussion of the power that these platforms exert over the complementary members of the ecosystem, see Cutolo and Kenney (2021).

understand the size and dynamics of these ecosystems to see the broader economic significance of platform firms.

Platform power, the literature shows, has two aspects: *artifactual* and *contractual* (Cutolo and Kenney, 2021). The artifactual aspect is inherent in the software and algorithmic structure of the platform. The software itself structures action—it enables certain activities and blocks others (Barrett *et al.*, 2016). The platform owner can change the code and algorithms at will, thereby reengineering user engagement with the platform. In addition to the algorithmic structure, platform users contract with the platform by agreeing to a set of terms and conditions. The typical terms and conditions reserve essentially all power to the platform owner. The algorithmic affordances and contractual conditions provide platforms nearly total control over users and firms utilizing the platform (Cutolo and Kenney, 2021).

The contractual levers of power that the platform wields, in respect to the complementors in its ecosystem, are enshrined in the terms and conditions that all actors must agree to prior to using the platform. 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 own white-label products; 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, Google 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 must be expressed in code and in contract.

The power of platforms lies in how they can orchestrate the activities of various participants, and that they determine the operation of the far more numerous ecosystem complementors. The foundations of platform power and their expression can be complex, scope-like extensions such as when Google began offering Maps, which built upon its strengths in cataloging enormous amounts of data and providing searchability. Building on the same competencies, Google acquired and expanded YouTube. These expansions can also be less obvious; for example, Google is a leader in developing autonomous vehicles, which is, in part, dependent upon excellent maps; at the same time the vehicles produce spatial and visual data that can improve maps (Bergen, 2018; Wilken and Thomas, 2019). This complex interaction between the vehicles and maps is all supported by Google's ability to process and catalog enormous amounts of data. Another expansion vector available to platform firms is to integrate other layers into the software stack. For example, Google has done this through its introduction of the Android operating system. These multidimensional expansions may be through acquisitions or new product development.

Platform presence may have begun with an innovative set of newcomers, but the original 'newcomers' such as Google, Amazon and Facebook, have grown into giants redefining the economy. But it is not just the giants on which one needs to focus. The task of the next section of this paper is to measure the extent of the insinuation of platforms into the economic fabric by creating a measure of pervasiveness.

3. Measuring the pervasiveness of platforms

While it is universally recognized that platforms have reorganized many industries, particularly within the enormous service sector (Cusumano *et al.*, 2019, 234), the presence of platforms across industries is underexplored. David Evans and Annabelle Gawer (2016) counted the number of ‘platform firms’ globally but did not enumerate the industries they impacted. More recently, Lafontaine and Sivadasan (2020) used a time series of NAICS retail establishment data to show that the growth of online commerce had a negative impact on physical retail in terms of numbers of establishment, employment, real sales and real payroll, including big box retailers. Geissinger *et al.* (2020) used mentions of platform firms in various Swedish media to measure their presence across sectors. Their results identified 17 sectors and 47 subsectors, including on-demand services, fashion and clothing, and food delivery, as being part of the ‘sharing economy,’ that is, platforms.

3.1 Methodology for determining platform presence at the six-digit NAICS code level

This section explores the presence of platforms across service industries using NAICS codes.⁹ NAICS is an industrial classification system that was developed in 1997 and has been updated most recently in 2017. NAICS divides industries into a two through a six-digit hierarchical system, with six-digits representing the greatest level of detail. Even at the six-digit level, which includes 1057 codes, there are a variety of firms undertaking different activities (Census Bureau, 2020a). In our analysis, we include 451 service industries that are diverse in their primary business activities and represent 43% of six-digit NAICS industries.^{10,11}

For each of the 451 six-digit industries, we consider whether a platform with reasonable market presence is intermediating transactions. In platform models, transactions are intermediated in two different ways. First, the platform may intermediate transactions between third-parties and consumers. In this case, we define a transaction through the platform as a *direct* effect of platform presence, as platforms directly consummate the transactions and capture value through their website or app. Second, the platform may connect users and possible providers, but no transaction occurs on the platform. We term this an *indirect* effect of platform presence, as platforms passively capture value through advertising, click streams, consumer data and more, but do not execute the final transaction. In other words,

- 9 Our analysis is confined to service industries, but platforms are impacting other sectors. For example, see Kenney *et al.*, (2020) for a preliminary discussion of their impact in agriculture.
- 10 For the list of 460 NAICS industries we used in our classification, please see Census Bureau (2020b). We dropped nine service industry classifications because they were excluded from the Statistics of U.S. Businesses, which we use for establishment data, thus our final population of NAICS codes was 451. The industries dropped include rail transportation (NAICS 482); postal service (NAICS 491); pension, health, welfare and vacation funds (NAICS 525110, 525120, 525190); trusts, estates and agency accounts (NAICS 525920); and private households (NAICS 814) (Census Bureau, 2020c). We also dropped Offices of Notaries (NAICS 541120) as a result of statistical challenges.
- 11 Although manufacturing industries are also affected by platforms, platforms have not directly affected the manufacturing processes, thus, they are excluded from this analysis. To illustrate, the Tide product was not changed because of platforms, but Procter & Gamble has designed the ‘Tide Eco-Box’ so that it is more easily deliverable by platform firms such as Amazon (Meyersohn, 2018).

Table 1 Effects of platform firms in a NAICS code

Definitions	Share of industries in sample affected, %	Number of establishments in sample affected, millions
Direct effect	34	2.0
Indirect effect	36	3.2
No effect	30	1.2

transactions are completed on another webpage, app or in-person, but they are enabled by improved discovery through the platform. Conversely, in traditional business models, transactions are ordered in a linear process extending from suppliers to the consumers, and platforms have *no effect* on value capture. Our classification of NAICS codes at the six-digit level is based on this logic, summarized in [Table 1](#).

Classifying platform presence in industries is difficult. We chose to examine whether a platform was intermediating transactions in a particular industry. This is because platforms reconfigure the way that transactions are completed, but not necessarily the end product. In order to standardize the classification process, we developed a questionnaire to determine the nature of transactions in each industry included in our sample. The following questions were asked for each industry: are any transactions intermediated in a significant way by a platform firm? Are transactions completed through the platform's website or app? Are transactions completed as a result of clicking an ad viewed on the platform's website or app, which then directs the user to make a purchase on another website?¹² Further details on the methodology are in the Appendix.

3.2 NAICS codes analysis results

Our overall finding was that platforms had a direct impact on 34% of the industries (2 037 384 establishments), an indirect effect on 36% (3 234 412 establishments), and no identifiable impact on 30% (1 096 823 establishments) of the 451 industries ([Table 1](#)). These results at the six-digit NAICS code level indicate that an enormous number of US service sector establishments are in industries that are being reorganized by platforms.¹³ The analysis identified several platforms that affect multiple industries at the six-digit NAICS code level. One of the most significant of these was Amazon, which directly affected 9% of all 451 industries (601 824 establishments). The Amazon marketplace is powerful and as discussed in the next section, the platform expands into many other industries aside from

¹² For the full classification protocol, please see the Appendix.

¹³ This is particularly remarkable considering that we are only including exchange platforms in our analysis.

retail. More surprisingly, Yelp indirectly affected establishments in 11% of all 451 industries (1 759 157 establishments).¹⁴

The analysis also identified many narrower platforms that affect clusters of industries, usually within the same or similar subsector at the three-digit level. These platforms largely remain within traditional industrial verticals. For example, platforms such as Lyft and Uber in transportation; Realtor.com and Zillow in real estate; Airbnb, Booking.com and TripAdvisor in travel and accommodation; Upwork and Fiverr in professional industries; Netflix, Spotify and YouTube in entertainment; and CarGuru and Edmunds in auto sales.

Table 2 lists a sample of six-digit NAICS code industries to illustrate the different effects of platforms on transactions in particular industries. In each case, we list one or more of the platforms that are present in the focal industry.

First, we consider industries *directly affected* by platforms. Take Electronic Stores (Industry NAICS code 443142), which encompasses retailing consumer-type electronic products. Amazon has directly affected the firms in this industry by shifting transactions that would have previously taken place in stores like Radio Shack to the Amazon Marketplace. Of course, Amazon also directly affects many other retail industries, as well as non-retail industries, such as Couriers and Express Delivery Services (Industry 492110), through Amazon Flex delivery partners. Similarly, firms in General Warehousing and Storage (Industry 493110) are directly affected by Flowspace, a platform that lists warehouses and fulfillment centers, where users pay via the platform to rent space.¹⁵ Finally, firms in Ambulance Services (621910) are directly affected by Uber, which has been shown to reduce ambulance use by 7% (Moskatel and Slusky, 2017). Uber Health, which provides health care organizations with non-emergency medical transportation, is also directly competing with firms in Ambulance Services.

Second, consider industries *indirectly affected* by platforms. Facebook is one of several platforms that has profoundly reorganized the News Syndicates (519110) industry. Facebook increasingly intermediates the production, discovery and consumption of news through its Newsfeed, through which users find articles and other content. Facebook passively captures value from data collection on user preferences and ad revenue, but the platform does not directly capture value from transactions that result from discovery on Newsfeed, Marketplace or other Facebook features. This is because users are redirected to an auxiliary website or individual, and when transactions occur (e.g. subscription to a newspaper, payment for an article, purchase from a person) they take place there. Another example is the Direct Life Insurance Carriers (524113) industry, where the insurance discovery process has been affected by platforms such as SelectQuote and ConsumerAdvocate; however, the product remains unchanged. SelectQuote, for example, ‘allows consumers to compare insurance policies for life, auto, and home insurance from providers including American International Group, Prudential Financial Inc [sic] and Liberty Mutual’ (Franklin, 2020). Insurance discovery platforms indirectly affect insurance industries because transactions continue to take place between traditional insurance providers and consumers, but

14 The percentages reflect only the industries where both coders agreed on Amazon and Yelp. Thus, the number may be greater.

15 We note that Amazon has also entered the logistics industry and built warehouses, however, this is not part of Amazon’s platform; rather, Amazon employees or contractors are working in Amazon-owned warehouses, in a manner consistent with traditional warehousing.

Table 2 Examples of industry typology for platform pervasiveness

Industry	Number of establishments (2017)	Platform example	Effect	Details
Electronic stores (443142)	13 670	Amazon	Direct	Amazon entered the electronics industry in 1999. In Amazon's Marketplace, thousands of vendors sell all manner of electronics products.
General warehousing and storage (493110)	12 317	Flowspace	Direct	Flowspace was founded in 2016 as an on-demand warehouse listing and booking with over 1000 certified warehouses in the network. The platform raised \$15.4 million in funding, including \$12 million in Series A funding in 2019 (Branley, 2019).
Ambulance services (621910)	5513	Uber/Uber Health	Direct	Uber was founded in 2009. Uber's entry into a city was found to reduce ambulance use by 7% (Moskatel and Slusky, 2019; Frakt, 2018).
News syndicates (519110)	412	Facebook, Instagram, Google News	Indirect	Facebook is one of several platforms that has profoundly reorganized the production, discovery, and consumption of news (Nechushtai 2018).
Direct life insurance carriers (524113)	8561	SelectQuote	Indirect	SelectQuote matches consumers with insurance providers. The platform raised \$360 million during its IPO in May 2020 (Franklin, 2020).
Full-service restaurant (722511)	250 871	Yelp	Indirect	Yelp is used by consumers to find restaurants, but transactions are not completed on the platform.
Pipeline transportation of crude oil (486110)	802	N/A	No effect	In this niche industry, no platforms were identified that affect business activity.
Elementary and Secondary Schools (611110)	22 164	N/A	No effect	In this industry, ongoing personal relationships are important. No platforms were identified that affect business activity in this industry. We do not include internal platforms such as Blackboard or tools such as Zoom. During the Covid-19 crisis, these digital tools have become increasingly important in providing remote education.
Food service contractors (722310)	27 844	N/A	No effect	No platforms were identified that affect business activity in this industry, which is composed of a group of establishments that provide contract food services at institutional, governmental, commercial or industrial locations. This industry is likely composed of firms that are engaged in mostly business-to-business (B2B) transactions.

For industry descriptions, see [Census Bureau \(2017\)](#). Establishment data from [Census Bureau \(2020d\)](#). Establishments are defined as single physical locations at which business is conducted or services or industrial operations are performed.

increasingly, consumers are using platforms to compare policy options and subsequently get routed to providers.

A final example of an indirect effect is in the Full-Service Restaurant (722511) industry, where individuals increasingly turn to Yelp (or Google) for reviews and recommendations. While the transaction occurs in the restaurant, Yelp and other review platforms are crucial in the decision-making process, and they passively capture value through users' data. In some sense, Yelp is similar to Yellow Pages, whereby consumers discover phone numbers and addresses of restaurants. However, recent reports have exposed that Yelp is creating their own phone number on restaurant pages so that they can charge restaurants a 15–20% 'referral fee' (Jeffries, 2019). Of course, with the Covid-19 pandemic, the role of platforms as intermediaries has become more pronounced than ever.

Third, consider industries that are *not affected* by platforms. In general, industries that are unaffected by platforms tend to be in niche markets (e.g. Pipeline Transportation of Crude Oil—486110, or financial services industries) or in markets where ongoing interpersonal relationships are important (e.g. Elementary and Secondary Schools: 611110). Industries that are dominated by B2B services, such as Food Service Contractors (722310), also tend to be unaffected by platforms. Although B2B platforms are growing—for example, Amazon has a special program for selling to businesses—business to consumer platforms are currently more pervasive.¹⁶

At a higher level of aggregation, the distribution of platforms by subsector (three-digit NAICS code level) and sector (two-digit NAICS code level) is informative. We found that platforms are affecting business activity in 45 out of 52 three-digit industries (87%). Certain subsectors appear to be more susceptible to platformization than others (i.e. more than 70% of industries in the subsector are affected by platforms). In particular, these subsectors are in sectors including retail trade (NAICS codes 44–45), transportation and warehousing (48–49), information (51), arts, entertainment and recreation (71), accommodation and food services (72) and other sectors (for greater detail, see Appendix Tables 1.1 and 1.2).

In the subsectors affected by platforms, we consider whether the direct or indirect effect dominates (i.e. at least 70% of industries in each subsector are affected either directly or indirectly; Appendix Table 1.2). In 16 subsectors, including electronic and appliance (443), transit and ground passenger transportation (485) and accommodation (721), the direct effect dominates. In six subsectors, including motor vehicle and parts dealers (441), scenic and sightseeing transportation (487) and food services and drinking places (722), the indirect effect dominates. In 10 subsectors, including gasoline stations (447), pipeline transportation (486) and telecommunications (517), no effect dominates.

This section has shown that platforms are active in a far broader range of industries than previously understood. We have introduced direct and indirect effects; the effects of the latter should not be underestimated as we demonstrated above in the case of Yelp, whose pervasive impact has only been increased by the Covid-19 pandemic. Moreover, it is possible that industries currently unaffected by platforms could become susceptible to platform transformation in the future. As Section 4 will show, using a detailed case study of Amazon, once

16 In some cases, we were uncertain as to whether a platform was impacting the industry. To illustrate, for Formal and Costume Wear Rental (532281), while we believed that platforms might exist, we were unable to identify them, suggesting that if they do exist, they do not possess significant market power, so they were classified as unaffected by platformization.

planted in an industry, a platform firm can rapidly spread across industries and accumulate power.

4. Amazon—the expansionary trajectory of a mega-platform firm¹⁷

The previous section identified the remarkable number of NAICS codes within which Amazon is present. In this section, we investigate the scale, scope and dynamics of Amazon's expansion to better understand the macro-level evolution of platforms.¹⁸ We identify eight expansion vectors that illustrate the ways through which Amazon is intermediating increasingly large sectors of the economy and how the firm's power has become so encompassing.¹⁹ When applicable, we note the similarities between Amazon's expansion vectors and the growth of other mega-platforms.

As [Figure 1](#) shows, Amazon is not one platform, but rather a constellation of services and platforms that include the Marketplace, Web Services, Logistics, Whole Foods and more. [Figure 1](#) divides the many Amazon services and platforms into eight expansion vectors: first party product sales, Marketplace, logistics, cloud services, model internationalization (globalization), entertainment, physical stores and physical devices. While these vectors are visually depicted as separate, Amazon connects them by drawing upon its

17 Methodological Note: The Amazon data used in this section was collected from a variety of sources. The most important sources for acquisitions were CrunchBase and Wikipedia, both of which have lists of Amazon acquisitions. For line extensions, we utilized the entire corpus of Amazon Annual Reports and press releases for all nations. We also examined the Amazon website historically through the Wayback Machine. We used four books on Amazon. The most important books were *The Everything Store* by Brad Stone (2013), *One Click* by Richard Brandt (2011), *Amazonia* by Richard Marcus (2005), *Behemoth, Amazon Rising* by Robin Gaster (2021). Additionally, we read countless newspaper articles. Unfortunately, the level of detail in press releases was too great to catalogue every product extension onto a spreadsheet. We did not read the press releases for non-US countries, as this article is not about the diffusion of Amazon services globally. Finally, press releases are useful but also limited. They do not announce every market withdrawal, nor do they announce every extension in sales categories or in private-label goods. For example, one of Amazon's largest private label goods is batteries (Cresswell, 2018), and yet we do not include its introduction in our timeline, instead subsuming it under the private label vector. Listing every acquisition or sales line extension, for example, listing the home page tabs on what is now a drop-down list, is not possible. We listed only the ones we judged to be the most important. Similarly, Alexa Internet, Inc., a web traffic analysis firm, was acquired in 1999 by Amazon for \$250 million. It remains a subsidiary, but should it be included in a graphic of Amazon's expansion? Alexa Internet is expanding by offering new services, but in revenue terms it is not significant. And yet, as a web services vendor, it can be viewed as the precursor to AWS. Moreover, it contributed the brand name "Alexa," the name of Amazon's cloud-based voice service.

18 Helmond *et al.* (2019) show this evolution can and does occur at the micro-level of the boundary resources that gradually envelope ecosystem complementors.

19 Because of the nature of digital technologies, Amazon operates with decentralized product teams that can constantly undertake experiments, such as A/B testing and the introduction of beta versions, to gauge market reaction, effectively probing the market digitally and in a variety of directions simultaneously. Amazon is constantly iterating and evolving; thus, linear models cannot adequately describe the platform's expansion vectors. It is also important to understand that these expansions often draw on a variety of Amazon capabilities.

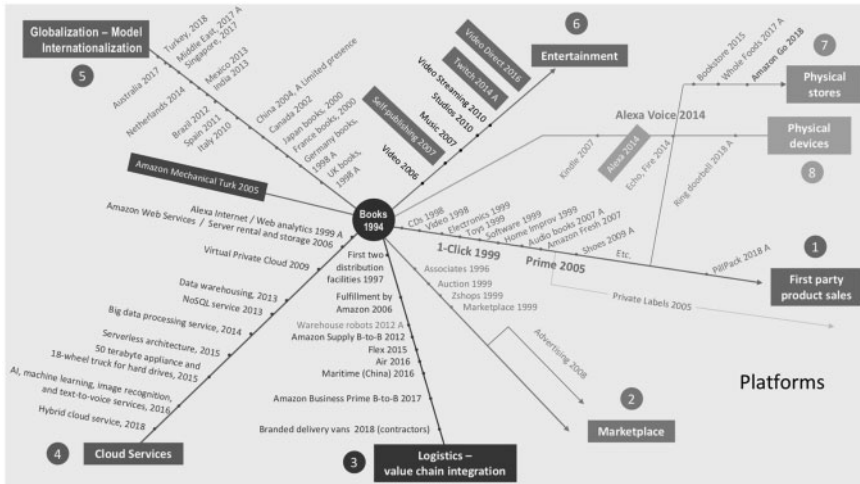


Figure 1 Amazon expansion vectors.

complementary assets such as massive computing capability, a logistics network and a huge consumer base (Aversa *et al.*, 2020). An important part of Amazon's strategy has been to invest heavily in infrastructure. This includes its development of a powerful logistics channel and data services for its own use and to rent to other firms, as well as Amazon Prime, which bundles entertainment channels, discounted products and rapid delivery. Amazon Prime was a unique marketing initiative, which, as a subscription that provides discounts, knits many of these vectors together for the consumer.

In the following sections, we explore these eight expansion vectors that show Amazon's growth from its founding in 1994 to the present. Each vector is studied as a separate dimension, though the interconnections between them are vital for understanding Amazon as a whole. It is the unfolding and evolving synergies between these various vectors that make Amazon's business model so dynamic.²⁰ When Amazon enters a sector, the competition is effectively 'unfair,' as its entrance is supported by powerful complementary assets and the potential for cross-subsidization.

4.1 A brief history of Amazon's early growth

Amazon was established in 1994 as an e-commerce book retailer. The goal was to create an easy-to-use retail website that had an enormous searchable catalog and the ability to deliver the book to its purchaser rapidly.²¹ During the dot-com bubble, Amazon was one of hundreds of retail websites—nearly all of which initially specialized in a single product. Effectively, Amazon was an online retailer with fulfillment outsourced to third parties (Stone, 2013). To attract more customers, Amazon introduced the Associates Program in 1996 to encourage referrals, whereby anybody with a website that mentioned a book could

²⁰ On dynamic capabilities, see Teece *et al.* (1997).

²¹ At its inception, Amazon could offset part of the delivery price by not charging state and local sales tax—a subsidy that balanced part of the delivery cost.

link it to the Amazon site and get a commission for a purchase—thus creating a digitally-enabled ecosystem of recommenders.

With the website growing rapidly and having established two distribution centers in 1997, in 1998, Amazon began selling compact disks. Compact disks were similar to books: a non-perishable, standardized product that benefited from a large searchable catalog. Selling books and CDs meant that Amazon's data centers would see increased traffic, with orders of the most popular titles fulfilled from Amazon's distribution centers—thus increasing their utilization—with other fulfillment outsourced to distributors. With the addition of compact disks, Amazon collected more data on customer's preferences, thereby improving its recommendation algorithm. Constantly improving and extending data and software, which are the integument that link all of Amazon's businesses. In 1998, Amazon began its international expansion. By 1999, just four years after its founding, Amazon had become the largest bookseller in the USA. In the following sections, we discuss the various vectors by which Amazon expanded its scale and scope.

4.2 Vector one: first-party product sales

Horizontal expansion began with book sales, illustrated at the center of [Figure 1](#). This vector exploited the growing number of shoppers attracted to the Amazon website. The addition of new product categories resulted in economies of scope as well as economies of scale, which attracted yet more website visitors, even as previous customers could purchase a wider variety of products. Amazon also benefited from the fact that, with the increased traffic, data centers and distribution facilities achieved greater utilization and could be expanded at a relatively low-cost. By the mid-2000s, Amazon had become a first-party seller of a remarkable variety of goods spanning a wide variety of retail categories, including compact disks, video cassettes, electronics, toys and home improvement tools. In 2007, it further extended its retail operations by launching Amazon Fresh for home delivery of groceries.

The evolution of Amazon's home page illustrates its horizontal expansion across product sales. In 2000, the Amazon (2000) home page displayed eight header tabs for books, music, DVD and video, electronics and software, toys and video games, home improvement, auctions and zShops. By 2004, the number of header tabs had decreased to six, including books, apparel and accessories, electronics, toys and games, music and magazine subscriptions (Amazon, 2004). Yet, the left-hand sidebar listed 29 product categories and subcategories and 10 other services. In 2020, Amazon's home page did not list any products in the header, but had a dropdown search menu at the top of the page with more than 50 categories.

In 2005, Amazon launched its private label products business, which has significantly expanded since.²² Amazon's most successful private label product is batteries. In USA, Amazon controls about one-third of all online battery sales and the share is growing ([Kabiri and Helm, 2018](#)). While the exact size of Amazon's private label business is unknown, estimates ranged from \$1–2.5 billion in 2019. In its most important white-label brand, Amazon Basics, there are at least 135 different products ([Kart, 2019](#)).

22 The introduction of its own private label merchandise, which is not unique to Amazon, introduced another source of competition for Amazon's direct suppliers and vendors in the Marketplace. The introduction of private labels has been criticized. Because Amazon has so much information on customers, it can optimally position its private labels against the suppliers of its inventory and the Marketplace vendors that are dependent upon it ([Khan, 2016](#); [Cutolo and Kenney, 2021](#)).

In 2005, Amazon introduced what would become a key marketing innovation, Amazon Prime. For \$79 per year, Amazon offered free, two-day shipping within the contiguous United States on all eligible purchases and discounted one-day shipping rates. When a consumer joined Prime, Amazon effectively became their primary online vendor. The cost of this lock-in is that Prime became a major drag on Amazon's earnings because one-day shipment was so expensive—a point we return to in the logistics section. Another benefit was that competitors were forced to respond in kind, thereby increasing competitors' costs even more, as they had less volume (Sainato 2019).

The increasing digitization of a remarkable variety of content-based products made it possible to extend offerings in new ways. For example, in 2005, Amazon began offering authors the opportunity to digitally self-publish and sell their book directly on the Amazon Marketplace. In this instance, Amazon used digital technologies to enter into direct competition with publishing houses. In 2008, Amazon purchased Audible to deliver audio books. These initiatives were synergistic with the introduction of the Kindle e-reader in 2007, which allowed Amazon to control the customer interface. Amazon continued to expand to encompass yet other segments of the supply chain—from publishing to selling and distributing books—as the digitization of books proceeded.

In 2012, Amazon introduced a B2B sales platform through which manufacturers and wholesalers could sell to retailers and each other. The decision to enter the wholesale market leveraged the same data and logistics networks Amazon developed for consumers and allows Amazon increased algorithmic visibility into another part of the supply chain.

As can be seen in Figure 2, Amazon sales grew rapidly. By the mid-2010s, Amazon had become a rival to the world's largest physical retailer, Walmart. At that time, Amazon did not have physical stores and stocked a far greater number of products in its warehouses than physical retailers, such as Walmart, could in their retail stores (Jiang *et al.*, 2011). Yet, despite rising sales and product variety, Amazon was only minimally profitable. If Amazon wished to be 'the everything store', it would have to stock an enormous number of products that would only be seldom ordered. The introduction of its Marketplace would allow it to meet the 'long tail' of demand without incurring the potentially enormous inventory costs (Brynjolfsson *et al.*, 2006).²³

4.3 Vector two: the marketplace platform

In the late 1990s, Amazon's most significant competitor was eBay (see Figure 2), whose auction business model meant that it was an 'asset-light' platform with its 'inventory' owned by sellers. eBay merely collected fees, making it very profitable. Amazon's first effort to integrate third parties was the previously mentioned Associates Program in 1996. In 1999, Amazon introduced an auction platform that was its first two-sided platform. That same year, Amazon introduced zShops, an e-mall platform that enabled merchants to create a virtual storefront on Amazon. Both of these failed. eBay had already tipped the auction market and for zShops, the e-mall concept never proved successful. While the eBay platform was profitable, Amazon continued to lose money on its first-party sales.

23 Long tails are important because when an e-commerce buyer visits a site and cannot find the item for which they are looking, another vendor is only a "click away." If that vendor has the product, the buyer is likely to return for other purchases, thus creating a potential lock-in.

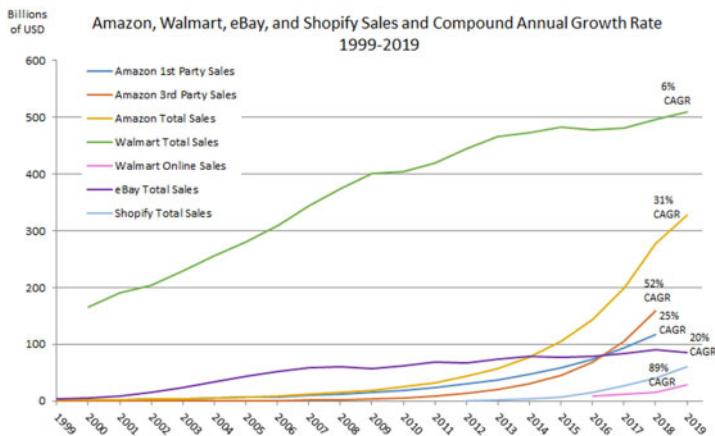


Figure 2 Amazon, Walmart, eBay and Shopify sales and compound annual growth rate, 1999–2019. Sources: Amazon, eBay, Shopify and Walmart annual reports. For Amazon, third-party sales were derived from Jeff Bezos’s letter in the Amazon 2018 Annual Report and calculated by year (Bezos, 2019). The Amazon total 2019 gross merchandise value (GMV) is an underestimate because it was calculated by extrapolating the 2018 to 2019 growth rate of Amazon’s sales and applying this growth rate to the Amazon’s total GMV in 2018. For Walmart, estimated online sales derived from MarketPulse (2020) estimates of Walmart.com online sales since 2016. Note: This figure has been annotated.

In 2002, Amazon introduced Marketplace, a platform through which third-party merchants could sell goods. Amazon’s innovation was that the third-party merchant’s goods appeared in the search results alongside Amazon’s own products if Amazon had that product in its inventory. Third-party merchants now gained access to Amazon’s huge customer base. For customers, the selection in terms of products, particularly used ones, exploded. Allowing third-party vendors, initially in used books, but soon in any product category, provided consumers with greater choice, attracting yet more consumers, and igniting powerful cross-platform network effects. Vendors stocked an enormous variety of products, and as a result, Amazon ‘had’, but no longer needed to stock items in low demand. To illustrate this point, Jiang *et al.* (2011, p. 757) found that Amazon listed 8010 different digital camera products in 2010. In comparison, Walmart.com had 408 and a Walmart store had 30 products in stock. Moreover, Amazon offered a range of price points for each camera product.

The Marketplace not only allowed third-party vendors access Amazon’s customers, but also provided them with templates, analytical tools and handled billing and payment. As Figure 2 shows, the Marketplace grew extremely rapidly and, by 2015, accounted for more than 50% of all Amazon merchandise sales. The enormous diversity of independent merchants meant Amazon truly had the greatest selection of products, thereby locking customers in. These third-party sellers provided not only revenue, but also increased Amazon’s sales and left little room for potential rival platforms. The increased volume of transactions allowed Amazon to further expand its data processing operations (Facility Executive, 2016).

As [Figure 2](#) indicates, Amazon's third-party sales exploded. By 2019, when combined with its own sales, Amazon transacted approximately 38% of all online retail sales ([Day and Soper, 2019](#)). As a result, in terms of total sales, in 2020 Amazon was approaching the size of Walmart and growing far more rapidly. Walmart.com was introduced in 2000 in response to firms such as Amazon and grew quickly, but sales were largely concentrated in the online grocery sector. In 2019, Walmart.com lost an estimated \$1 billion per year on \$28 billion in sales ([Del Rey, 2020](#)). However, the Covid-19 crisis dramatically increased grocery sales for both Amazon and Walmart. By one estimate, Amazon Fresh and Whole Foods online sales increased 400% from March 2019 to March 2020 ([Del Rey, 2020](#)), while Walmart's online sales increased by 74%, though from a much smaller base ([Bain, 2020](#)).

By 2018, Amazon Marketplace's dominance had grown to the point that 47% of shopping searches 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 a new source of income: on-site advertising for its third-party vendors, thereby extracting more value from them. As Amazon achieved dominance, it could observe the sales of all the products of its third-party vendors and thus had unique insight into 'hot' new products. Effectively, the third-party sellers acted as pioneers and innovators identifying attractive new markets for Amazon to consider entering ([Khan, 2016](#); [Zhu and Liu, 2018](#)).

The Marketplace platform is central to Amazon's pervasiveness. The sheer variety of products sold on Amazon means that it competes with all retailers, from Walmart to the corner store. To guarantee that Amazon has the lowest prices, it pressures sellers to not offer cheaper items through any other venue, including the vendor's own online store and, until 2019, required a 'most favored nation' clause in all vendor contracts forbidding them from offering the product cheaper elsewhere ([Kelly, 2019](#)). This strategy reduced consumers' incentive to buy directly from the seller's website—an action that would deprive Amazon of its commission. Amazon's market power against its third-party vendors is apparent in its ability to constantly raise listing fees, change the terms of service, and even to introduce its own private label brands in direct competition with its independent vendors ([Cutolo and Kenney, 2021](#)). Because of its primacy, third-party vendors do not have the choice to exit Amazon and sell on a competitor's marketplace.

Amazon's power is so great that there is even a [Wikipedia \(2020\)](#) entry for the 'Amazon effect,' which refers to the fact that Amazon's entry into a new retail market segment results in a devaluation of the segment's incumbents. Finally, Amazon and the gradual shift to online sales has led to the closure of many brick-and-mortar retail operations, a process that was accelerated by the Covid-19 pandemic of 2020, leaving Amazon more powerful than ever (e.g. [Danziger, 2020](#); [Randewich, 2020](#)).

4.4 Vector three: logistics and value chain integration

The developments in Amazon fulfillment must be situated in the context of the ever-increasing sales volume and increasing diversity of products sold, as described in the previous sections. This meant that as Amazon expanded its existing warehouses and built ever more, it also became more capable of managing product variety, not only in terms of numbers but also in terms of shape, size, character and weight. The constant addition of new warehouses meant Amazon could be located ever closer to customers, enabling faster and less expensive delivery ([Kenney and Zysman, 2020](#)).

Amazon initially set up warehouses in states with low in-state volumes and low sales taxes. For example, Amazon served the high-sales tax California market from low-sales tax Nevada and, similarly, the high-sales tax East Coast markets from low-sales tax Virginia. Prior to 2002, fulfillment was considered less important than expanding sales and adding new product categories. But in 2002, Amazon decided that fulfillment should become one of its core competencies and began a massive investment program to increase capabilities and capacity. It pioneered the transformation of logistics from bulk warehousing that delivered to retail outlets to one aimed at greater efficiency in fulfilling individual product orders (Stone, 2013, p. 171). This transition required new software and far greater data processing capability.

As sales grew, Amazon negotiated increasingly large volume discounts from logistics suppliers. In 2006, Amazon introduced Fulfillment by Amazon, which allowed its Marketplace sellers to use Amazon fulfillment infrastructure. Because of its volume, Amazon could get much better terms from shippers than its sellers could get on their own. As a result, Amazon saved sellers money on shipping costs and made profit on the arbitrage.

As Amazon became the dominant online retail platform, it collected ever more data and discovered new consumer patterns such as what would be purchased, where and when. Armed with this data and with the introduction of Amazon Prime two-day delivery, Amazon expanded its physical assets, including warehouses, long-haul trucks, airplanes, cargo ships, and built an international freight-forwarding operation to import products for Chinese vendors. As delivery and warehouse labor became a greater part of Amazon's wage bill, it began automating its warehouses. In pursuit of this goal, it purchased warehouse robot maker Kiva Systems in 2012.

As it built out its warehouse operations, Amazon remained dependent upon last-mile delivery firms. But in 2015, Amazon introduced Flex, which recruited individuals with their own vehicle to deliver packages from its warehouses to consumers. With this new service, Amazon began competing with the United States Postal Service (USPS) and delivery firms such as FedEx and UPS. In September 2018, Amazon announced a pilot program called Delivery Service Partner. For this program, it purchased 20 000 delivery vans and recruited a massive network of dedicated contractors. Amazon provided trucks, training and on-demand support to these delivery service providers (Soper, 2020). In late 2019, it announced the gradual purchase of 100 000 electric delivery vans (Blanco, 2019). These dedicated contractors are supplanting Amazon Flex operations. In 2019, in USA, Amazon delivered 3.5 billion packages, which accounts for 50% of all the items sold on its website—the other 50% was delivered by USPS, UPS or FedEx. In comparison, UPS delivered 5.2 billion packages in 2019 (Del Rey, 2019). With its infrastructure around every major US city and a network of delivery contractors, in 2019, Amazon introduced next-day delivery. While this dramatically raised Amazon's costs, the costs of matching this initiative are proving to be difficult or impossible for competitors. In the Covid-19 crisis, this infrastructure provided Amazon with an ability to gain even more market share.

4.5 Vector four: cloud services

To operate, Amazon built a cloud computing infrastructure. In 2006, it offered the use of its computing capacity to outside entities and introduced Amazon Web Services (AWS). Amazon recognized that data processing was a commodity and processing benefited from economies of scale—bigger data centers were less expensive to operate on a per-calculation

basis (Barroso and Hölzle, 2009). Amazon was the first of the mega-platforms to recognize that providing on-demand computing (cloud) services to third-parties at a lower price than they could do in-house was possible and could be profitable. This allowed Amazon to use its own computing infrastructure more efficiently by providing the service to others and doing load shifting. At first, AWS only provided computing, but as Figure 1 shows, it rapidly expanded to offer data storage, software and other related activities. In 2016, it introduced artificial intelligence and image recognition functionalities. Amazon Web Services also provided APIs so that third parties could provide yet other services to AWS users. By the third quarter of 2020, AWS was the largest software-as-a-service cloud provider with approximately 32% of the global market, followed by Microsoft and Google (Canalys, 2020).

While not a part of AWS, Amazon Mechanical Turk (AMT) is included here because, like AWS, it is a service developed for internal use that was made available to outside parties. AMT is a contract labor platform upon which one can hire people to undertake micro-tasks that require some human intelligence.²⁴ The tasks include classifying images to train artificial intelligence and answering simple surveys. While AMT has received much attention from academics due to its extremely low levels of compensation (Gray and Suri, 2019), the revenue it generates is minimal.

4.6 Vector five: globalization and model internationalization

Only 4 years after its establishment, in 1998, Amazon expanded to Western Europe by acquiring book retail websites in the UK and Germany. In 2000, Amazon established Japanese and French subsidiaries. As of 2019, Amazon operated subsidiaries in 16 countries and the Middle East, but, of course, shipped to many more countries. In each country, Amazon could analyze existing data on products and shipping when deciding whether to establish a subsidiary, which provided deep insight into the size of the market opportunity. With the exception of its abortive foray into the Chinese market, Amazon largely reproduces its US model in each country. The typical pattern is to use local logistics providers and expand operations over time.

The Amazon Marketplace attracted international customers quickly. As in USA it began building out its fulfillment infrastructure, introduced Prime, and has become a powerful competitor in its host nations. In 2019, Amazon was estimated to be responsible for 27% of all online sales in Germany (Lommer, 2019). In 2015, it established a German logistics network and by 2019 operated four sorting centers, 13 distribution centers and had started building delivery operations (Rozycki and Kerr, 2019). In 2019, Amazon captured 30% of the UK online retail market (Skeldon, 2019) and was expanding its logistics operations. In Japan, Amazon has struggled with the local e-commerce firm, Rakuten, with each capturing approximately 20% of the market (Brigham, 2019). Amazon's internationalization benefits from its infrastructure of software, data processing and logistics knowledge, which has made it the largest online retailer in the world, outside of China.

4.7 Vector six: entertainment

Amazon expanded to music and video in the mid-2000s by selling music and video downloads. In 2010, Amazon established its own studios and began commissioning exclusive

²⁴ Mechanical Turk is an allusion to a late 18th century fake chess-playing machine that was actually powered by a hidden human being.

content, thereby competing with established, powerful rivals including Apple, Netflix and Disney. In 2014, Amazon purchased the gaming platform, Twitch. As with self-publishing, in 2016, Amazon introduced the Video Direct platform, which allowed independent filmmakers to upload films and get paid per view (Patel, 2019). All of these applications are extremely data-intensive and thus increased demand for computation, which had become one of Amazon's core competencies. While Amazon has not yet dominated the entertainment industry in the way that it has with online shopping or cloud computing, it became a significant competitor by leveraging Amazon Prime membership and its knowledge of customers' viewing habits.

4.8 Vector seven: physical stores

Amazon also embarked upon what was initially a tentative expansion into physical retail by opening a bookstore in Seattle in 2015. In 2017, Amazon acquired the Whole Foods chain for \$13.7 billion. The acquisition provided Amazon with a national network of grocery stores and distribution centers that it could use to strengthen its position in the online grocery delivery sector where it competed with Walmart and traditional grocers. Finally, in 2018 Amazon introduced the highly automated Go convenience stores. By 2020, there were only 26 Amazon Go stores in USA. With the exception of Whole Foods, physical stores are only a small part of Amazon's vast portfolio.

4.9 Vector eight: physical devices

As Amazon sought to lock in customers, it introduced various physical devices to eliminate the possibility that physical device or operating system firms such as Microsoft could disintermediate Amazon, while more deeply integrating customers into Amazon. As books were increasingly being read online on notebook computers, Amazon decided to introduce a dedicated eBook reader, the Kindle, which it introduced in 2007. Of course, the Kindle facilitated Amazon's sales of e-books and thus reinforced its move into direct publishing. In 2011, Amazon introduced the Fire, which could be used for streaming video, thus moving to protect its video sales business. In 2014, Amazon introduced Fire TV to allow high-definition streaming for televisions. Finally, in 2014, Amazon introduced the Fire Phone, which experienced little market success.

Another important area of growth is Amazon's voice recognition software Alexa, which is used in Amazon's smart speakers, Ring doorbells and on the Amazon app for iOS and Android. It is used in approximately 100 million home smart speakers for various purposes, including ordering products. Later, Alexa was incorporated into various smart appliances. Alexa has some open APIs that have spawned an ecosystem of app makers that have created new functionalities (Hardawar, 2017; Pymnts, 2020). Amazon has competition in voice recognition, from Google and Apple.

4.10 Synthesis

Amazon, as one of the platform giants, is both an anomalous and iconic case study for exploring the scale and scope of the most powerful mega-platforms. It is instructive because of its remarkable expansion into many industries—a characteristic not only of mega-platforms but also of smaller sectoral platforms. This characteristic is, in large part, a result of the generativity (Zittrain, 2008) and recombability (Henfridsson *et al.*, 2018) of digital technologies to provide low-cost and software-enabled opportunities for experimentation and

expansion. Successful platforms such as Amazon are so central to socioeconomic activity that they can be understood as the infrastructure in the sectors that they organize (Plantin *et al.*, 2018).

Amazon began as a bookseller, but today, it is simultaneously one of the largest retailers in the world, one of the largest online marketplaces, a provider of physical logistics and cloud computing services, an operator of a contract work platform (AMT) and a provider of entertainment services and physical devices. On the surface, this could appear to be an incoherent conglomerate overseeing too many services to manage them efficiently. However, these services are intertwined through data, software and processing power to form a single, expansive and powerful firm capable of experimenting with and, where successful, growing in many directions simultaneously. Amazon is also not a conglomerate in the sense that a disparate set of activities are connected largely by financial linkages and allocation decisions (e.g. Stein, 1997; Rajan *et al.*, 2000).

While we simplified Amazon's expansions to eight vectors, very often a new initiative will combine two or more capabilities from the different vectors (Aversa, 2020). Because of the low cost of experimentation, a new initiative can be undertaken easily and inexpensively, and, if successful, receive more resources to expand further. If unsuccessful, it can be abandoned with little loss.

Amazon illustrates many dimensions of pervasiveness. During the Covid-19 pandemic, Amazon's power has only grown. With 40% of total market share prior to the pandemic, Amazon will likely become even more pervasive. It has been rumored to be considering expanding from its automobile comparison site (i.e. Amazon Vehicle) to direct sales and selling pharmaceuticals (i.e. PillPack acquisition) (Burke, 2017; Terlep and Stevens, 2018; Associated Press, 2020). Amazon's various complementary assets, ranging from enormous amounts of data on customers, global-class artificial intelligence software, inexpensive computing and a sophisticated logistics system optimized for single-package delivery ensure it is readily equipped to expand further into other products and services.

Because of its sheer size and the fact that for many products, it is the largest single online retailer—with 15% first-party and 35% overall market share—Amazon has enormous power over suppliers. For example, Evans (2019) estimated that 'Amazon has 50% or more of the US print book market, and at least three-quarters of publishers' eBook sales.' The other aspect of its power is that if it wishes to enter a segment, it can subsidize entry, lowering prices equivalent to or below cost, as it did when entering the online diaper business (Oremus, 2013). In other market segments, such as groceries, Amazon has little power, though it can subsidize its losses from its other, more profitable, businesses. In this respect, Amazon's market power cannot be measured in single markets—it must be understood as part of a complex whole able to focus human, computational and financial resources on any target for expansion.

Analytically, comprehending Amazon's expansion path is difficult because it has expanded on multiple vectors simultaneously. Moreover, it has not focused on short-term profitability, but rather, on growth facilitated by access to low-cost capital—first from venture capital and then from a stock market willing to forgive losses and low profit margins. Though not representative of the typical platform firm, Amazon illustrates the remarkable flexibility that digital technologies afford for expansion into other business sectors. And, perhaps, most important, how these platform firms have become increasingly central to the operation of ever more parts of the contemporary economy.

5. Conclusion

Platforms are ever more pervasive in the global economy and, as a result, are shifting the locus of power and value capture to the platform as the intermediary. They are becoming the infrastructure of and intermediaries for an ever larger number of industrial sectors of the economy (Plantin *et al.*, 2018). Because infrastructures have powerful lock-ins, the users, that is, the establishments in our NAICS industries, are often at the mercy of the platform. For example, Yelp has insinuated itself as the intermediary and, indeed, is a vital infrastructural element in the entire restaurant industry. Nonetheless, it is a profit-maximizing firm intent on extracting the maximum profit from restaurants in its ecosystem. When we view a platform in this way, we see that value creation is accompanied by value extraction that is only possible because it has become a powerful infrastructural component for the entire industry.

While this article is largely descriptive—an appropriate strategy when examining a new phenomenon that is still developing—it suggests a number of research directions. First, the NAICS codes, themselves, allow for more granular research. Because the NAICS codes are a long time-series, it should be possible to identify when the first platform firm entered an industry and thus discern the impact on establishment numbers and employment. It is also possible to exploit our ‘direct,’ ‘indirect’ and ‘no effect’ distinctions to see whether there are differential impacts—with the ‘no effect’ being the control group. Finally, because the NAICS codes data is available at the subnational level, it is possible to study the impact geographically. Researchers and policy-makers have only recently become aware of the increasingly pervasive role platforms are playing in the economy. By providing an admittedly aggregate picture, we create the basis for further attempts to measure the impact of platforms.

The pairing of the macro-level Amazon case study with the NAICS data allows a granular understanding of how a single platform firm grew by creating new platforms and non-platform capabilities. In the winner-take-most markets within which platforms operate, once a particular market is captured, if growth is the goal, then it is incumbent to add new services or penetrate new sectors. Amazon’s expansion is thus an extreme case due to its size, but it is not atypical, rather, it exposes a dynamic. While expansion is, of course, a compulsion for capitalist enterprises, in the platform world these characteristics occur at the speed of software upgrades and extensions.

The insights from the case study of Amazon, illustrates the scale and scope that platform firms can develop, as they enter and transform the dynamics of previously self-contained industrial sectors. To document Amazon’s expansion over time, we identified and discussed eight expansion vectors. While Amazon’s growth is exceptional, it provides insight into expansion dynamics common to platform firms. To illustrate, Uber began in black limousines, but now has many different types of services, including UberEats, JUMP Electric Bike Share, UberCash and Uber Health. As another example, Airbnb expanded globally from accommodation to other services such as vacation rentals, and then added multi-family property owners and hosting teams, experiences and neighborhoods. Another promising field of research would be understanding the motivations and dynamics of platform expansion.

The recent investigations and enforcement actions in Europe against mega-platforms such as Google, Amazon and Facebook, suggest policy-makers in Europe and USA are becoming aware of the power of online platform firms (European Commission, 2020a;

European Commission, 2020b; U.S. District Court for the District of Columbia, 2020). Their focus on the mega-platforms is understandable, but we have shown that platforms are also reorganizing narrower sectors and may be having powerful impacts there as well. Our demonstration of the pervasiveness of platforms suggests that a more profound regulatory response predicated upon understanding the mechanisms that platforms use to reorganize industries may be more fruitful than the current reactive policy-making.

Platforms are becoming a fundamental organizing institutional form for the entire economy. Better understanding of the logic and dynamism of platform firms will contribute to the formulation of better policy, to ensure that these organizations are not just extracting value and wealth, but also contributing to greater societal goals.

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Appendix

Additional details on methodology

Two individual evaluators were trained to execute the identification process. The training involved 43 industry categories (7% of the sample of 460 NAICS codes) and the set classification protocol. The evaluators understood the definition of exchange platforms and were well-versed in literature on platforms, thus, they had substantial prior knowledge about how a platform's operation could be considered significant and the ways in which platforms intermediate transactions. Some online research was undertaken in the more obscure industry categories, but most of the exercise was based on preexisting knowledge. Upon completion of the classification exercise, the coders' percent agreement was 68%. If we consider only whether the coders agreed on whether platforms affected a given industry, and not on the type of effect (i.e. direct or indirect), then agreement increased to 80%. Accounting for the random chance of agreement, inter-rater reliability for the former is 0.5144 and for the latter is 0.5456, representing moderate agreement in both cases (see [Tables 2.1](#) and [2.2fc](#)).

To determine the final classification, we undertook the following procedure in the case of disagreements: if the coders agreed that platforms affect the industry but disagreed on

whether the effect was direct or indirect, the default would be indirect. If the coders disagreed on whether a platform was present in the industry or not, the decision was discussed with Martin Kenney and a consensus was reached. In the few cases that remained unresolved, we defaulted to ‘no effect’.

This exercise allowed the identification of platform presence in a remarkable diversity of service industries and provides quantitative evidence of the extent to which platforms are becoming pervasive. Yet, narrow functional typologies of platform firms, such as the one presented in this section, whereby platform firms are classified according to their main activity, have advantages and disadvantages (OECD, 2019, p. 63). In this case, there are a few methodological issues to note. First, although a framework for decisions was developed and a resolution process occurred in the case of disagreements, the analysis was still dependent upon coder discretion. We mitigated bias by using two coders. Furthermore, as noted previously, we account for random chance of agreement in our estimation of inter-rater reliability, which represents moderate agreement (see Tables 2.1 and 2.2). Second, to determine whether an industry might be affected by platforms, we asked coders to identify a platform with a ‘reasonable market presence’ in USA, which, also, is subjective. As Table 2 shows, there are ways to interpret reasonable market impact, but they are not uniform. Third, identifying a single platform firm with market presence in an industry does not mean that the industry has been entirely transformed or reorganized by platforms.

CLASSIFICATION PROTOCOL

Instructions

In this exercise, we are attempting to determine if and how platforms are affecting industries across the economy. When we say ‘platform’, we are referring to a digital exchange platform firm, defined as online places or infrastructures (i.e. websites and mobile apps) designed specifically to facilitate transactions and other valued exchanges of goods, information and opinion (Gawer, 2014). In some instances, platforms are *directly* affecting an industry, meaning one may transact (i.e. buy or sell a good or service) directly through the platform from a third-party. For example, taxi services may be bought through Uber/Lyft in the transportation industry. On the other hand, platforms may *indirectly* affect an industry, meaning that platforms connect buyers and sellers, but no transaction is made on the platform itself. For example, Yelp connects people to restaurants in the restaurant industry and Zillow connects buyers to real estate agents in the real estate industry. Finally, it is possible that some industries are virtually unaffected by platforms, meaning that their transactions have been largely unchanged by platforms.

With that in mind, please go through the following questions for each of the listed industries to determine if and how an industry is affected by platforms. Below is an example of what your spreadsheet will look like based on the examples provided:

You will find descriptions of the 2017 NAICS codes [here](#).

Classification protocol

- (1) In this industry, are any transactions/interactions intermediated in a significant way by a platform firm?

Table A1.1 Three-digit NAICS code analysis

NAICS code	Industry	Platform effect, direct, and indirect (%)	Direct effect (%)	Indirect effect (%)	No effect (%)
441	Motor vehicle and parts dealers	100	29	71	0
442	Furniture and home furnishings stores	100	100	0	0
443	Electronics and appliance stores	100	100	0	0
444	Building material and garden equipment and supplies dealers	100	100	0	0
445	Food and beverage stores	100	100	0	0
446	Health and personal care stores	100	100	0	0
447	Gasoline stations	0	0	0	100
448	Clothing and accessories stores	100	100	0	0
451	Sporting goods, hobby, musical instrument and book stores	100	83	17	0
452	General merchandise stores	100	100	0	0
453	Miscellaneous store retailers	89	56	33	11
454	Non-store retailers	50	50	0	50
481	Air transportation	80	80	0	20
483	Water transportation	67	17	50	33
484	Truck transportation	100	67	33	0
485	Transit and ground passenger transportation	91	82	9	9
486	Pipeline transportation	0	0	0	100
487	Scenic and sightseeing transportation	100	0	100	0
488	Support activities for transportation	15	0	15	85
492	Couriers and messengers	100	100	0	0
493	Warehousing and storage	25	25	0	75
511	Publishing industries (except Internet)	100	43	57	0
512	Motion picture and sound recording industries	90	80	10	10
515	Broadcasting (except Internet)	100	100	0	0
517	Telecommunications	0	0	0	100
518	Data processing, hosting and related services	100	100	0	0
519	Other information services	100	75	25	0

continued

Table A1.1 Continued

NAICS code	Industry	Platform effect, direct, and indirect (%)	Direct effect (%)	Indirect effect (%)	No effect (%)
521	Monetary authorities-central bank	0	0	0	100
522	Credit intermediation and related activities	57	43	14	43
523	Securities, commodity contracts and other financial investments and related activities	50	50	0	50
524	Insurance carriers and related activities	40	0	40	60
525	Funds, trusts and other financial vehicles	50	50	0	50
531	Real estate	56	0	56	44
532	Rental and leasing services	43	14	29	57
533	Lessors of nonfinancial intangible assets (except copyrighted works)	0	0	0	100
541	Professional, scientific and technical services	79	42	38	21
551	Management of companies and enterprises	0	0	0	100
561	Administrative and support services	73	24	48	27
562	Waste management and remediation services	9	9	0	91
611	Educational services	71	24	47	29
621	Ambulatory health care services	76	10	67	24
622	Hospitals	0	0	0	100
623	Nursing and residential care facilities	83	50	33	17
624	Social assistance	33	11	22	67
711	Performing arts, spectator sports and related industries	91	0	91	9
712	Museums, historical sites and similar institutions	100	0	100	0
713	Amusement, gambling and recreation industries	70	20	50	30
721	Accommodation	86	71	14	14
722	Food services and drinking places	88	0	88	13
811	Repair and maintenance	89	0	89	11
812	Personal and laundry services	63	0	63	38
813	Religious, grant-making, civic, professional and similar organizations	54	0	54	46

Note: For NAICS sector, subsector, industry group, NAICS industry and national industry descriptions, please see 2017 NAICS code descriptions.

Table A1.2 Sectors with highest concentration of industries affected

Sector (two-digit)	Subsectors with >70% of industries affected, direct and indirect	Subsectors with >70% of industries directly affected	Subsectors with >70% of industries indirectly affected	Subsectors with >70% of industries not affected
Retail trade (44–45)	441, 442, 443, 444, 445, 446, 448, 451, 452, 453	442, 443, 444, 445, 446, 448, 451, 452	441	447
Transportation and warehousing (48–49)	481, 485, 487, 492	481, 485, 492	487	486, 488, 493
Information (51)	511, 512, 515, 518, 519	512, 515, 518, 519		517
Finance and insurance (52)				521
Real estate and rental and leasing (53)				533
Professional, scientific, and technical services (54)	541			551
Management of companies and enterprises (55)				562
Administrative and support and waste management and remediation services (56)	561			
Educational services (61)	611			
Health care and social assistance (62)	621, 623			622
Arts, entertainment, and recreation (71)	711, 712, 713		711, 712	
Accommodation and food services (72)	721, 722	721	722	
Other services (except public administration) (81)	811		811	

- (a) If yes, go to question 2. Please put the name of the identified platform(s) in Column C.
- (b) If no, then this industry is *not affected* by platforms. Please put a 3 in Column D.
- (2) Are transactions/interactions completed through the platform’s website or app?
 - (a) If yes, then this industry is *directly affected* by platforms. Please put a 1 in Column D.
 - (b) If no, go to question 3.
- (3) Are transactions/interactions completed off of the platform’s website or app?

Table A2.1 Inter-rater reliability

		Reviewer 1		
		Direct	Indirect	No effect
Reviewer 2	Direct	126	27	37
	Indirect	26	77	18
	No effect	23	13	104

Inter-rater reliability was calculated using this website: <http://vassarstats.net/kappa.html>.

Table A2.2 Inter-rater reliability

		Reviewer 1	
		Direct or indirect	No effect
Reviewer 2	Direct or indirect	256	55
	No effect	36	104

Inter-rater reliability was calculated using this website: <http://vassarstats.net/kappa.html>.

- (a) If yes, then this industry is *indirectly affected* by platforms. Please put a 2 in Column D.
- (b) If no, then go to question 4.
- (4) Are transactions/interactions completed as a result of clicking an ad viewed on the platform’s website or app, which then directs the user to make a purchase on another website?
 - (a) If yes, then this industry is *indirectly affected* by platforms. Please put a 2 in Column D.
 - (b) If no, go to question 5.
- (5) Are transactions/interactions completed for ‘free’ on the platform’s website or app?
 - (a) If yes, then this industry is *directly affected* by platforms. Please put a 1 in Column D.
 - (b) If no, go to question 6.
- (6) If none of the above are true, please explain how transactions are intermediated via platform in the ‘Note’ Column G: _____