DENK FABRIK DIGITALE ARBEITS-GESELLSCHAFT

WORKING PAPER

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Measuring the Impacts of Labor in the Platform Economy

New Work Created, Old Work Reorganized, and Value Creation Reconfigured

Diese Publikation ist im Rahmen des Transatlantischen Dialogs in Kooperation mit dem Berkeley Roundtable on International Economy entstanden und wurde von der Denkfabrik Digitale Arbeitsgesellschaft des BMAS finanziell gefördert. Die Durchführung der Untersuchungen sowie die daraus folgenden Schlussfolgerungen sind von den Autor*innen in eigener wissenschaftlicher Verantwortung vorgenommen worden.

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BERKELEY ROUNDTABLE ON
THE INTERNATIONAL ECONOMY

BRIE Working Paper
2019-5

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June 2019 (Revised July 2020)

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Abstract

Though economists have examined labor displacement due to digitization, few have considered the new work and value created. Studies of platforms invariably focus on specific organizational forms such as sharing or gigs. They build taxonomies based on the platform's organization – few consider the scope and scale of platform-enabled value creation. We consider all of the platform-enabled value creation activities including old work displaced or reorganized to new work created. We apply our framework to the work generated by Etsy and Amazon publishing.
Keywords: Platform Economy, Technology, Work, Employment, Value Creation, Digitization

JEL classification: J0, O1, O3

1. Introduction

As online digital platforms organize increasingly large parts of the economy, some jobs are displaced, new value creation opportunities are created, and above all work, workplace arrangements and labor markets are reconfigured and transformed. Some of the reconfiguration is facilitated and even, perhaps the product of technologies themselves, while the remainder of the transformation is determined by business strategy and policy choices. In this paper, we introduce a taxonomy with categories that effectively encompass the remarkable diversity of ways platforms transform and reconfigure value creation, labor and employment in the United States; but much of which should be generalizable to other nations.[1] The taxonomy is intended to categorize work in the platform economy, not the entire economy. However, the state of the platform economy mirrors the state of the general economy. Just as General Motors – the iconic example of corporate labor relations and organization in the 20th century – had the highest market capitalization in the 1950s, today in the United States, the top seven (two of which are Chinese) publicly traded firms by market capitalization are platforms.[2]

Platforms have been defined in a variety of ways (Baldwin & Woodward, 2009; Parker et al., 2016; Evans, Hagiu, & Schmalensee, 2006). We adopt Gawer's (2014: 1240) definition "that platforms are evolving organizations or meta-organizations that: (1) federate and coordinate constitutive agents who can innovate and compete; (2) create value by generating and harnessing economies of scope in supply or/and in demand side of the markets; and (3) entail a modular technological architecture composed of a core and a periphery." Any platform thus implies the

[1] At the outset, it is important to clarify that we are not presenting a general framework for the entire economy, rather, we are presenting a categorization of work in the platform economy. Not all work is a part of the platform economy, for instance, healthcare and physical work remain largely on the periphery. Having said that, platforms are affecting an increasing share of economic activity.

[2] These firms include Microsoft, Apple, Amazon, Google, and Facebook. If we were to include international firms, Alibaba would place ahead of Facebook. This is based on May 2020 data.

presence of a group of actors, or complementors, that supply complementary products and services that generate value for the core platform's users and, of course, the platform itself (Gawer & Cusumano, 2002; Parker et al., 2016). Complementors join a platform's ecosystem for a variety of reasons (Boudreau & Jeppesen, 2015; Cutolo & Kenney, 2020; Jeppesen & Frederiksen, 2006). For our purposes, this discussion is confined to online digital platforms.

Platforms are reorganizing economic activity as the factory did in the era prior to digitization. They transform and reconfigure labor relations, production and markets at a speed, scope and scale that is unprecedented. In the 20th century, the factory was the emblem and embodiment of new forms of value creation (Coriat, 1994; Gramsci, 1971; Boyer, 1990). It consolidated workers and work, making them easier to observe and manage, while making it simpler to reorganize and increase the efficiency and effectiveness of the work process (Thompson, 1966). Indeed, the very inputs to production and the resulting products that were sold also changed. Under the Fordist industrial system, government regulations and union power were strong, factory employment conditions were effectively set and regulated by collective bargaining, managerial relations were organized in a Chandlerian hierarchy with internal job ladders and little intercorporate mobility (Lazonick, 2009; Piore, 2002). These relatively high-productivity, mass-production jobs paid middle-class wages to millions of Americans with only high-school degrees that then, with their college-educated, white-collar counterparts, became a powerful consumption base (Lazonick, 2009).

The digital revolution undergirded by the semiconductor with its ever-increasing processing power gradually moved the locus of innovation and value creation from the old Fordist firms to a new set of firms based on exploiting the affordances provided by digital technologies (see, for example, Florida and Kenney, 1990; Lazonick, 2009). After the

introduction of the minicomputers, the bulk of these firms were established in Silicon Valley and venture capital-financed (Kenney and von Burg, 1999). These firms emerged against and over time contributed to the backdrop of declining union membership and power, the offshoring of work to low wage areas of the world, and automation that changed skills mixes and compensation (Autor et al., 2015; Goos et al., 2014).[3] Together these developments have, the evidence suggests eroded middle skilled and middle income, particularly blue-collar jobs. Simultaneously, outsourcing and temp work, supply chain and supply networks fractured and fissured work (Huws, 2009 & 2014; Hyman, 2018; Weil, 2014). These changes in composition of the workforce and labor relations had macroeconomic consequences: real wages stagnated or declined for workers in the bottom half of the income distribution, productivity outpaced real wage growth, and the labor share of national income declined in the US and other advanced industrial economies (OECD, 2018; Manyika et al., 2019). Furthermore, the deliberate and continuing attacks on unions resulted in the decline of unionization meant that labor institutions that historically supported higher wages are no longer effective (Jacobs and Myers, 2014; Lazonick, 2009).

Beginning in the early 1990s, the process of commercializing the Internet began. This led to the introduction and rapid acceptance of online platforms, which has led to their intermediating an increasing number of markets and labor markets (Kenney and Zysman, 2016; 2020; Srnicek, 2017; Van Dijck et al., 2018). The rise of digital platforms prompts a number of important questions: What new categories of work are created by digital platform firms?[4] Can

[3] Lazonick (2009) makes the point that the offshoring went to locations with capable workforces and management. Additionally, of course, these locations had to have infrastructure of sufficient quality to be able support the work offshored.

[4] Work can be considered a value creating activity, some of which is captured in the employment relationship, some of it necessary, and some is uncompensated value creation. In this paper, we define work as compensated or uncompensated labor, employment as compensated labor, and value creation as anything consumers are willing to purchase.

economic activity and jobs enabled by digital platforms fill the void left by the decline of blue-collar jobs? Will economic activity and jobs enabled by digital platforms guarantee middle-income or decent compensation to the vast majority of individuals working such jobs? What types of regulations and institutions should be developed or adapted to protect workers and maintain healthy competition in the platform economy? Whether platforms will accelerate trends that began in the 20th century thereby exacerbating inequality or pave the way for new forms or work that have the potential to guarantee decent livelihoods is still unknown, but evidence presented in this paper suggests that platforms are contributing to increasing inequality in the labor market. They are compensating their direct manager and engineering employees very well, while it should be noted that Amazon's employees in their warehouses and delivery operations and the 25,000 Apple employees in direct sales have wages that are not significantly higher than minimum wages. Overall, platformization of increasing numbers of workers is accelerating trends toward precarious and low-wage work. However, this is not an inevitable outcome – what is certain is that policy and business strategy can shape the trajectory.

As digital platforms continue to transform and reconfigure work, and profoundly alter market logic and dynamics, answering these questions takes on greater urgency. Nonetheless, as a first step, we must systematically identify the distinct categories of work that platforms enable. Entire ecosystems of activity are enabled by a single successful platform (Jacobides et al., 2018), and for each actor within the ecosystem there are distinct concerns and policy implications. Current research regarding labor in the platform economy so often generalizes from a narrow type of work on a single platform, be it so-called "sharing economy" firms such as Uber or Lyft (Berg & Johnston, 2019; Cramer & Krueger, 2016; Frenken & Schor, 2017), Airbnb (Zervas et al., 2017), remote gig work firms such as Upwork (Popiel, 2017) or Amazon Mechanical Turk

(Ross et al., 2010), therefore, our current understanding of work in the platform economy is limited. Each of these studies claim to discover an essential learning about the emerging economy and its impact upon work and the particular features that digital transactions permit – generalizing from the specific.[5]

This paper proposes a comprehensive framework for understanding and measuring all types of work, employment and value creation in the platform economy. We provide suggestive evidence for the utility of our framework and case studies to illuminate the framework's categories and analysis. Classifying labor relations in the platform economy is a necessary first step to understand evolving labor relations and implications for quality of work in a vastly altered workplace.

2. Literature Review

In the platform economy, work is being reorganized, dispersed and recomposed, making it harder to observe and count (Kenney & Zysman, 2016). There have been a number of taxonomies introduced to classify work in the platform economy. Each of the existing taxonomies capture certain dimensions of how labor is organized in the platform economy, yet their shortcomings are that they do not consider the totality of the types of labor and value-creating processes undertaken on and through platforms.

Table 1 presents a sample of existing theoretical and empirical classifications of labor in the platform economy. The OECD (2016) describes two categories of platform labor in service markets, services delivered physically (e.g. Airbnb) vs. digitally (e.g. Upwork), and demonstrates the way that they contribute to long-term trends in non-standard work arrangements. Pesole et al. (2018) offer a classification that also focuses on service-providers with an emphasis on where

[5] For recent exceptions to these "sharing economy" formulations, see Kirchner and Schüßler (2018) and Frenken et al. (2018).

work occurs. Huws et al. (2017) provides a broad definition of "crowdwork" as paid work via online platforms.

[TABLE 1: Sample of Existing Classifications of Labor in the Platform Economy, Theoretical and Empirical]

In general, most labor taxonomies of the platform economy make three major assumptions: 1) only compensated labor should be considered, 2) platform work is exclusively in service provision, and, 3) classifications are limited to work intermediated by platforms, and thus they exclude activities, such as, lawyers, photographers, script writers, etc. that may, for example, assist YouTubers in creating videos, these can be termed "indirect" platform workers. Because of the pervasiveness of platforms in economic and social life, nearly all economic activity would be included in our analysis.

Given the lack of definitional agreement, measurement challenges are endemic to all studies examining work in the platform economy (Abraham et al., 2018; Abraham & Amaya, 2019; Allard & Polivka, 2018; Bracha & Burke, 2018).[6] Using various methodologies, a number of studies agree that platforms intermediate a growing share of economic activity in terms of work, occupations and markets (Scott & Orlikowski, 2012; Van Dijck, 2013; Barley, 2015). For example, one study finds that independent contracting work, much of which is intermediated by platforms, is growing at approximately three times the pace of the overall US workforce (Upwork, 2017), with gains driven by the transportation and services sector (Abraham et al., 2018; Farrell et al., 2018). From 2012 to 2015, the number of Uber drivers in the US increased from near zero to approximately 460,000 (Hall & Krueger, 2018), and by 2020 it was estimated that Uber had 3.9 million drivers globally (Iqbal, 2020). In 2018, Upwork claimed to have 16

[6] Even IRS tax returns can only provide suggestive evidence of an increase in nonstandard work arrangements that are contingent and coordinated through online platforms (Jackson et al., 2017; Abraham et al., 2018).

million contractors (Meeker, 2018). Nonetheless, the most recent estimates are that electronically-mediated work represents approximately one percent of total US employment (Bureau of Labor Statistics, 2018a; Farrell et al., 2018; Katz & Krueger, 2019), which might lead to the conclusion that platform-generated income is insignificant. With a broader perspective on the ecosystem of platform-enabled economic activity, it is clear that platforms are creating and changing a much larger share of work, employment, and value creation making complete classification and accurate measurement of the distinct types of platform-enabled work and work conditions increasingly important.

3. A Taxonomy of Platform Work, Employment, and Value Creation

In this section, we present a taxonomy of labor in the platform economy that accounts for the totality of work arrangements generated, extracting some categories from the analytical frameworks discussed in the literature review, as well as introducing new ones. Economists have conceptualized platforms as "multi-sided markets" that intermediate activity between a variety of sides (Rochet and Tirole, 2003). For example, YouTube (Google) owns the platform that intermediates between video creators, viewers, and advertisers, while Etsy owns the platform that intermediates between its vendors and buyers (Parker et al., 2016). The platform firm owns the market that matches supply and demand between parties. There are three fundamental actors in the platform economy: the platform firm, platform-dependent goods or service providers, and prosumers (coined by Ritzer & Jurgenson, 2010). Each of these actors is essential to the functioning of the platform economy, and each is the site of distinct categories of labor. We identify seven categories of labor in the platform economy.[7]

[7] In reality, platform-induced creation and reorganization of work, employment and value-creation extends far beyond direct relationships between producers, consumers, and even third parties such as advertisers to encompass many other intermediaries and suppliers. In the case of all successful platforms, an ecosystem of activity emerges

[TABLE 2: Labor Force Distinctions in the Platform Economy]

On the platform side, value creation occurs *within* the platform firm, whereas in the platform-dependent business and prosumer sides, value creation is *enabled by the platform ecosystem*. Work in the platform side is done by direct employees and contractors of platform firms. Platform-dependent businesses include all types of compensated labor that is intermediated by platforms. The prosumer represents users whose activity on the platform may be monetized by platforms (e.g., writing reviews, click data, etc.), but they are not necessarily compensated directly. For each of the categories, we consider the diversity of; a) employment type, b) typical firms, c) compensation type, d) labor conditions, and e) value-creation process.

Our taxonomy is valuable for understanding the platform economy, as it extends previous work in a number of significant ways. First, we include the employees of the platform firms. Even including the 100,000s of Amazon physical workers in its logistics operations and Apple's 25,000 retail sales personnel in its Apple Stores, the number of employees at platform firms is remarkably small. Platform firms actively segment their workforce into the privileged regular employees (again with the exceptions noted above) and an army of low-paid contractors with few worker rights and protections. We then categorize the types of work undertaken within a platform's ecosystem and briefly describe the nature of this work and the compensation system. This, roughly paralleled, much of the previous contributions categorizing work. Finally, in contrast to much of the economics literature, we explore the role of prosumers, who by using the platform create the data from which the platform owners extract value. This is a vitally important point that is omitted by many of the earlier taxonomies.

3.1 Platform

around the platform – these include not only direct providers, but also a variety of other parties (Tiwana, 2013). The structure of each ecosystem has vastly different implications for various workers.

3.1.1 Direct Employees

The *first*, and most straightforward to observe, category of workers are direct employees of the platform firm. These employees are most similar to what we consider traditional employment, characterized by a standard employment contract between the firm and worker. These are normally full-time employees who are compensated with excellent salaries and stock options, as well as in-kind remuneration. These employees also receive worker protections, health coverage, and many other benefits. In return, they are expected to work long hours as the firm rushes to be first to the market. These jobs are less secure than the white-collar worker in the previous Fordist regime. In particular, insecurity is high in the early stages of the firm's growth, where their jobs are susceptible to termination due to firm reorganization or failure (for a more detailed discussion, see Lazonick, 2009; Neff, 2012). As **Figure 1** shows, while a relatively small group in secular terms, the number of persons directly employed by platform firms has increased significantly since the early 2000s, and particularly recently, as there has been an explosion of investment (Kenney & Zysman, 2019b).

[FIGURE 1: Platform Firm Direct Employment, 1995-2018]

Platform firm direct employees are disproportionately professionals and staff.[8] **Figure 2 Panel A** provides the share of employees by job category from 2014 to 2017 for a sample of core platform firms, including Facebook, Google, Microsoft, Apple, Airbnb, and eBay. During this period, total employment at these firms increased, but the increase was exclusively professionals. In fact, the already low share of staff and laborers and service workers declined from 7% and 1% in 2014 to 5% and 0.3% in 2017 respectively. The exception is Amazon (**Figure 2 Panel B**),

[8]The job categories included as "professional" are executive/senior officials & managers, first/mid officials & managers, professionals, and technicians, sales. The job categories that we include as "staff" are administrative support and craft workers. The final job categories that termed "laborers and service workers" encompasses operatives, laborers & helpers, and service workers.

where net employment rose in all job categories, but the laborers and service workers share of employment increased most rapidly as it built out its network of warehouses and logistics operations. While this paper does not directly address race and gender issues, it is well-known that women, Hispanics and African-Americans were under-represented and Asians were over-represented in professional job categories. The employment gains of African Americans were almost exclusively in low-paid job categories.

[FIGURE 2: Panel A: Share of Employees by Job Category at Select Platform Firms]

[FIGURE 2: Panel B: Share of Employees by Job Category at Amazon]

Since the early 2000s, the revenue of these platform firms has increased substantially (**Figure 3 Panel B**). As the sample of key platform firms in **Figure 3 Panel A** demonstrates, revenue per employee is remarkably high and has trended upward, with the exception of Amazon, which recently hired enormous numbers of warehouse and logistics workers (see **Figure 2**).

It is instructive to compare the performance of these platform giants with the digital giants of the previous era. To control for market fluctuations, we compare valuations in the previous high-technology stock market bubble of 1999. In 1999, valuations of Microsoft was $637,000 (Inflation adjusted = $977,512), and Cisco, which had the benefit of the dot.com boom for its best years ever, earned $590,599 (inflation adjusted 2019 = $881,627.80). In 2001, HP's revenue per employee after the lower-revenue Agilent was spun-off was $524,362 (inflation adjusted 2019 = $757,109.42). Notice that Google, Facebook, Apple, and Amazon, before it began building out its logistics operations, had revenues per employee in excess of $1,000,000 and, at times, in excess of $1.5 million. eBay also had revenues in excess of $700,000 per

employee during most of these years. The per employee revenue of the mega-platforms is unprecedented.

This performance suggests that where the marginal cost of adding new customers and services is very low, revenue can increase more rapidly than employment. However, as discussed in the next section these remarkable per employee revenue results are also a function of the ways the firm's direct labor force is divided between regular employees and temporary and contract employees that work for the firm both remotely and on-site.

[FIGURE 3: Panel A: Revenue per Employee by Year in Thousands of 2018 Dollars, 1995-2018]

[FIGURE 3: Panel B: Platform Firm Revenue in Millions of 2018 Dollars, 1995-2018]

3.1.2 Contract and Temporary Employees

Platform firms also employ, often through contractors, a variety of *temporary employees* to cut labor costs, adjust to demand fluctuations, or access short-term expertise (Kalleberg, 2009; Hyman, 2018). Platform firms flourish with fewer employees than the most successful firms of the prior era not only because of highly productive digital technologies that substitute for labor, but also because much of the work, such as coding, training software, content moderation, digital map editing, search engine quality control, and so many other tasks is done by workers that are not employed directly by the platform firm (Gillespie, 2018; Gray & Suri, 2019). Other non-digital menial in-person tasks, such as food service, security, and custodial work are also outsourced (Irwin, 2017; Hyman, 2018).

As is the case with most firms, the platform firms do not release the number of temporary workers they use, however, anecdotal evidence suggests that firms use enormous numbers of them. For example, a recent news article suggests that Google "employs" more contract,

temporary, and vendor personnel than it has regularly employed workers (Wakabayashi, 2019), and this is the case for other platform firms as well. To illustrate, Upwork has only 570 employees and internally used 1,200 contractors in 2019 (Upwork, 2019).

Temp workers are compensated by a variety of mechanisms – hours worked, salary from a temporary agency, or by the job. They do not have the worker protections, benefits and perks that full-time employees have. Further, to ensure that they cannot be reclassified, even if they work on-site and directly with full-time employees, they have different badges and are forbidden from accessing the perks or participating in employee meetings (Wakabayashi, 2019). This enormous and diverse workforce is located both on-site and globally. However, what they share is that their employment is limited in duration and precarious.

3.2 Platform-Dependent Businesses

The *second category* includes the various types of providers of goods and services intermediated by online platforms, what we term platform-dependent businesses (Cutolo and Kenney, 2020).[9] This remarkably diverse category includes Amazon vendors, Uber drivers, YouTube video bloggers, Upworkers and others that supply goods or services through platforms. One way of measuring the growth of this category is through the change in the number of 1099-K tax returns, which are filed by individuals whose work is intermediated through online platforms. As **Figure 4** indicates, since 2012 when the 1099-K was initiated, filings have grown substantially faster than both 1099-MISC and W-2 filings by a substantial margin. By 2017, the latest date for which filings are available, 1099-K filings had increased by over 30%. While the

[9] We term this type of labor platform-dependent businesses because these individuals are classified as independent contractors by the platform companies that intermediate their work. However, there is a debate about whether or not they should be considered employees of the firm. For example, see Dynamex Operations West, Inc. vs. The Superior Court of Los Angeles County (No. S222732, April 30, 2018) and Assembly Bill No. 5 (September 18, 2018) in California and Pimlico Plumbers Ltd and another vs. Smith (UKSC 2017/0053, June 13, 2018) in the UK.

total number of filings of the 1099-Ks is far lower than 1099-MISCs and W-2s, the growth rates suggest that the number of platform-dependent businesses continue to increase.[10] While platform-dependent businesses vary with respect to work arrangements, the returns nearly always have a long-tail distribution, whereby most receive little or no income, while a few reap large returns, thus creating a skewed distribution (Brynjolfsson et al., 2011). This is almost certainly the case when considering the 1099-K filings, as a recipient only receives this form if they conduct over 200 transactions or receive in excess of $20,000, so this is certainly an underestimate of the total income from these electronic sources. In the following subsections, we describe distinct categories of work that make up platform-dependent businesses.

[FIGURE 4: 1099-MISC and K versus W-2 Filings, 2006-2020]

3.2.1 Platform-Dependent Vendors

Platform-dependent vendors are those selling goods intermediated by platform marketplaces. These include sellers on Alibaba, Amazon, Craigslist, eBay, Etsy, and many other smaller platforms.[11] The vendors pay the platform some combination of a listing fee or commission. This fee is determined by the platform, and may be changed at the discretion of the platform. In some cases, such marketplace operators are or can become substantial firms. Such successes include Casper, Colourpop, Warby Parker, Zalando, Asos, and a myriad of other brands that began entirely online and have grown to have substantial workforces. For instance, Warby Parker established in 2010 had grown to an estimated 1,400 employees in 2019 (Hollis, 2019).

[10] Platform-dependent workers and businesses that do not meet the requirements for the 1099-K file 1099-MISCs, however, it is important to note that not all platform-dependent receive a 1099-K or 1099-MISC, and not all workers who receive these forms are platform-dependent (Jackson et al., 2017; Abraham et al., 2018).

[11] We omit the Shopify platform that is the back-end platform for merchants selling through their own websites. Shopify provides the software and now logistics that enable an online merchant to sell through their own website without having to build their own payment systems etc. Shopify provides the services that Amazon offers to vendors using its Marketplace, while not threatening its customers because Shopify does not have its own retail operation.

3.2.2 Platform-Dependent In-Person Service Provision

Platform-dependent in-person service providers have drawn perhaps the most attention and encompass individuals that offer physical services through a platform and include those renting goods (OECD, 2016). Examples include the independent contractors who are drivers for Didi, Lyft, Uber, or BlaBlaCar (Casprini et al. 2019; Cramer & Krueger, 2016); couriers and deliverers for Deliveroo, DoorDash, GrubHub, PostMates, and many others; lessors on Airbnb or VRBO; caregivers on Eldercare.com, among many other examples (De Stefano, 2015). Individuals renting out goods online (e.g., Airbnb) or providing a good plus service (e.g., BlaBlaCar, Didi, Lyft, or Uber) had been euphemistically labeled as participating in a "sharing economy," (Laamanen, 2018; Schor, 2016). This misnomer has been almost entirely abandoned as others pointed out that nothing was being “shared,” but rather the goods and services were being provided or rented for money, often under exploitative conditions (on Uber, see, for example, Rosenblat, 2018). This is also evident for rental platforms such as Airbnb, which were originally conceived as individuals sharing extra rooms for travelers, but have largely become short-term rentals. These in-person service provision platforms have grown rapidly, if not profitably, and now encompass large numbers of workers. With the exception of the short-term rental markets, few of these platforms provide sufficient income or benefits for anything more than a poverty-level existence, though for part-timers they can provide extra income (Zwick, 2018).

3.2.3 Platform-Dependent Remote Service Providers

Platform-dependent remote service provision or what can be termed “virtual gig work” has received much attention (OECD, 2016). In this case, the work is contracted for and provided digitally through the platform, thus there is no constraint on geographic location (Wood et al.,

2018). The variety of services provided is remarkable ranging from micro-work provided through sites such as the Amazon Mechanical Turk to more sophisticated tasks, such as, search engine optimization, graphic design, programming, manuscript editing, and translation among many other tasks. The iconic example is freelancers on Upwork. Compensation is typically agreed upon by the job and paid upon completion. There are a variety of other schemes such as the one used by Innocentives, a crowd-sourcing website where customers offer cash rewards for solving "challenges," which are technical problems for which they are searching for innovative solutions. Thus, the workers in this category can range from those with high school educations to Ph.Ds. in sciences or engineering.

3.2.4 Platform-Dependent Consignment Content Creators

Platform-dependent consignment content creators create and post digital goods on various platforms. This category includes individuals that produce websites to be found by Google Search, videos for YouTube, the smartphone apps available from the Apple Appstore or Google Play, game play on Twitch, WeChat, Blogger, SoundCloud, and many more platforms. It is enormous in terms of the amount of content and revenues (see, for example, Bergvall-Kåreborn & Howcroft, 2013). With respect to individuals and organizations creating websites, this is an enormous category of content creators that are, in part, doing this to be discovered by Google. The business model in this category is that the platform does not pay for the content and it is only monetized through either sales when streamed or downloaded (e.g., App stores) or when viewed accompanied by advertising (e.g., YouTube or TikTok). It is important to recognize on some of these platforms the creators have developed sophisticated off-platform monetization strategies for leveraging their fame or notoriety to create opportunities for

increasing their income through personal appearances, product endorsements, platform-driven merchandise sales, etc. (Cutolo & Kenney, forthcoming).

3.3 Prosumer

The explosion of user-generated content has resulted in a situation, whereby individuals are producing valuable data that may be monetized as they consume digital content. An outcome that Ritzer and Jurgenson (2010) term “prosumption." The internet and the key digital platforms are a massive machine for collecting data that can be monetized in many ways. Effectively, as individuals surf the web, click through websites, and upload user-generated content, they are creating data streams that the platform firms mine. With such data, the platforms can sell advertisements and, of course, use the content to attract yet other users. This type of value creation can be termed “user-generated content” (Terranova, 2000). One measure of the value of this data is Google’s and Facebook’s 2019 advertising income, which was, respectively, $120 billion and $55 billion. The profits these firms earn by selling the prosumers’ information is the result of this uncompensated value creation, and is the business model for two of the most valuable five firms in the world. In other words, the "free" use of many platforms for prosumers is sponsored by advertisers buying insights derived from the users’ data.[12]

4. Case Studies: Etsy and Amazon Self-Publishing

The following two case studies demonstrate the utility of our taxonomy for understanding the types of work that these platforms make possible. These two cases are chosen from different sectors and have different business models. Etsy is a retailer and Amazon self-publishing is part of the publishing industry, yet the cases identify common types of labor at each platform firm

[12] In our taxonomy, advertisers would fall into the category of platform-dependent business.

and within their supplier and consumer ecosystem. Finally, for each case study, we provide tentative estimates of the number of workers per category and its related ecosystem.

4.1 Retailing and Etsy

To understand how retail platforms are reorganizing labor, we first examine the general industry trends. We subsequently turn to Etsy, a major online retailer, to explore the variety of labor utilized by Etsy and its ecosystem, as well as how platforms like Etsy and, of course, the far bigger Amazon and its Marketplace are driving a profound reorganization of the retail industry.

In 2018, there were 5,468 US retail store closures (Coresight, 2018), subsequently 2019 experienced record store closures (Thomas, 2019), and then the 2020 COVID-19 pandemic has accelerated the movement to online commerce, further devastating physical retailers. Despite the store closures, until the COVID-19 crisis, retail was not shrinking. In fact, retail employment as a percent of total nonfarm employment had remained relatively stable since 1954 (Hortaçsu & Syverson, 2015). In 2019, almost 16 million people were employed in retail, representing approximately one in every ten workers, and revenue continued to increase. However, with the COVID-19 crisis and the shutdowns physical retail employment has collapsed.[13]

The closures of established retail businesses without a corresponding decline in retail employment is, in part, explained by the rise of e-commerce, as shown in **Figure 5**.[14] Since 2001, the number of online shopping establishments increased from 3,625 to more than 20,000 – an increase of 460 percent – while the number of department stores declined by 16 percent

[13] Statistics are from the FRED database on all US employees in retail trade (accessed on 3/4/19), as well as the US Census database.

[14] It cannot explain much of the decline, since e-commerce employment (as it is counted by the Bureau of Labor Statistics) is still fairly small. An increase in employment in warehouse clubs and supercenters played a part in offsetting the decline in employment in department stores.

(Bureau of Labor Statistics, 2017a). According to one study, from 2007 to 2017, the combination of warehousing and electronic shopping industries added 405,000 jobs, while brick-and-mortar retail lost the equivalent of 140,000 full-time jobs (Mandel, 2017). And yet, e-commerce employment still accounts for a relatively small proportion of total retail employment, as almost three-fourths of e-commerce establishments have 1 to 4 employees (**Figure 6**).

[FIGURE 5: Number of Establishments in Selected Retail Industries, 2000-2016]

[FIGURE 6: Share of E-Commerce Sales versus Employment in Selected Retail Industries, 2006-2016]

Four occupations – retail salespersons, cashiers, stock clerks and order fillers, and supervisors of retail sales workers – account for nearly two-thirds of retail employment (Bureau of Labor Statistics, 2014). However, as e-commerce and retail via digital platforms continues to grow, the types of occupations and labor demanded in the retail industry will shift substantially. Etsy illustrates the platform's role in this transformation and reorganization.

4.1.1 Etsy

Etsy was founded in 2005 as an online marketplace for handcrafted and vintage goods. From its launch, merchandise sales increased from $0.17 million to $3.25 billion in 2017 (Etsy, 2018). In 2019, Etsy had 2.7 million active sellers, 46.4 million customers worldwide, and listed over 50 million items for sale (Etsy, 2019d). In **Table 3**, we decompose the types of work enabled by Etsy and its ecosystem.

[TABLE 3: Etsy Employment by Category]

4.1.2 Direct Employees and Contractors

While the Etsy platform offers a virtual storefront to millions of sellers and customers, in December 2019, Etsy had only 1,240 employees. This mirrored the low employee-to-customer

and -provider ratios typical of platform firms. Most of the Etsy employees are highly skilled and well paid. To illustrate, postings on the jobsite Glassdoor indicate that a substantial share of these positions earn in excess of $100,000 annually. Etsy also offers generous benefits, including comprehensive health insurance without premiums, 26-week parental leave, paid sabbaticals and family leave, back-up childcare services, and access to gym and other fitness programs (Moskowitz, 2018).

Etsy's direct employees are tasked with creating, maintaining, and marketing the platform, as well as mediating the seller-to-client interactions. These occupations include titles such as "Engineering Manager, Machine Learning Infrastructure" or "UX Research Manager," clearly quite different from the traditional retail occupation titles such as purchasing manager or store manager. Etsy employees overwhelmingly were college educated, had years of expertise, and many had software or customer experience management skills. Since these skills are in short supply, compensation is high and the working environment is attractive. Etsy also hires highly skilled individuals as contractors to provide short-term expertise or to meet seasonal demand, but the number of these contractors is impossible to estimate due to data limitations.

Etsy's career portal does not list any positions for low-wage, physically-intensive service jobs such as custodial, dining or security staff, as these are largely outsourced to a temp agency or cleaning or security firm. There are also large numbers of contract workers that Etsy uses to vet products offered for sale, curate the website, and undertake a variety of other tasks.[15] While contract work is a part of Etsy's employment effects, it is difficult to estimate their numbers however it is almost certainly as large as their full-time employees.

4.1.3 Platform-Dependent Businesses

[15] To illustrate, it is estimated that Google employs as many contractors and temps as it does regular employees (Bergen & Eidelson, 2018).

In 2019, Etsy hosted 2.7 million platform-dependent vendors. When an individual becomes an Etsy seller, they create a "free" profile – an uncompensated upfront time investment and agree to the terms and conditions. The vendor pays Etsy base, transaction, and processing fees for each transaction consummated on the virtual marketplace (Etsy, 2019c).[16] In 2019, the average active seller on Etsy with four years of experience sold $5,004 of merchandise (Etsy, 2019d) Given the national median pay of $49,160 for craft and fine arts workers in 2018 (Bureau of Labor Statistics, 2018b), the average active and experienced Etsy vendor is earning far less than that. It is difficult to be certain about the distribution of sales, but it is certain that few sellers would meet this threshold. Rather, there is likely a long-tail distribution among its sellers with a small number responsible for a significant portion of all sales, while the remaining vendors have fewer sales and highly volatile income (Reddit, 2015). The sellers on the platform are classified as independent businesses and thus receive no benefits or other considerations from the platform.

For Etsy in particular, there is an employment multiplier generated by their vendors; in other words, the ecosystem of indirect economic activity that has emerged to support Etsy vendors. To illustrate, prior to any sale, a Etsy vendor engages in value creation that ranges from brainstorming, buying tools and supplies, utilizing web-based design software, marketing, purchasing advertisements, customer relations, partnering with distributors, etc. Often, these are provided by service providers specialized in supporting online vendors and are constituents of large ecosystems that emerge around the larger platforms (Tiwana, 2013). According to Etsy (2019c), in 2018, its vendors generated more than $1 billion in revenue, and were responsible for over $850 million in wages and income for US workers, which is equivalent to median annual

[16] The fees we described are for the most basic Etsy listing, there are other fees that apply should additional features be added.

income for 14,000 individuals (Fontenot et al., 2018). These numbers that Etsy claims are remarkable, considering that 79 percent of Etsy sellers are businesses with a single employee and 97 percent operate from their homes (McManus, 2017; Etsy, 2019a).

4.1.4 Prosumer-Generated Content

The 46.4 million active customers mentioned earlier, and many additional users who merely browsed the site are prosumers. When anyone, whether potential buyers or sellers, use the Etsy platform, their activities are monitored and the resultant data is captured. All data generating activity – a click, page view, a pop-up – is collected by Etsy (Bednarz, 2013) and analyzed by the data analytics team that algorithmically sifts through data to search for ways to optimize the sales and revenues from the website. This includes making continuous changes including small, quick tweaks to the web design, selling process, user experience, etc. (Snyder, 2013) and, of course, more seldomly larger changes. The data can be used to optimize the buyers' or sellers' experiences and also improve the ability of Etsy to extract revenues from its platform. The data can provide sellers with insights that allows them to better target potential buyers or provide buyers with a more customized user experience. The goal of the collection and analysis of all of this data is to monetize it.

The effort to extract data is constant. For example, once the prosumer purchases and receives an item, they are prompted to rank and review the item and seller. Similarly, the seller is asked to rank the buyer. These rankings are a form of user-generated content that provides value to the seller, potential future buyers, and, of course, the platform. These rankings are used to curate the platform, identify problems, and when combined with more data such as credit card information and user profiles, can be used for a remarkable variety of other purposes including A/B testing and sales targeting or, even, in certain cases may be sold to third parties.

By systematically identifying the distinct types of Etsy-related labor using the taxonomy, we dissected the various quantities and consequences of new, platform-based work in terms of workers compensation, benefits and protections, and job security. In the next section, we turn to the case of Amazon publishing to study its impact on work creation and organization in the publishing industry, which, unlike retail and e-commerce, has seen a dramatic decline in employment corresponding with the rise of digital platforms.

4.2 Publishing and Amazon

Digitization and platforms have played a major role in reorganizing the publishing industry. This section focuses on book publishers, which have experienced substantial declines in recorded employment over the past 20 years. As platforms have become an increasingly dominant tool used to put together, market and distribute books, they have absorbed many of the tasks previously done by traditional book publishers and shifted the remaining tasks onto authors and other individuals with niche skills; for example, cover design, manuscript layout, Kindle content producers, and audiobook narrators.

According to the Bureau of Labor Statistics (2017b), publishing is one of the most rapidly declining industries in the US. Typical occupations within publishing include advertising sales agents, editors, and graphic designers. As **Figure 7** illustrates, aggregate employment in publishing industries began to decrease in 2001 and intensified during the Great Recession in 2008. Since 2013, employment has stagnated at approximately 725,000 – a 30 percent decline since 2000. Yet the dramatic decline in traditional publishing employment has not been accompanied by an equivalent decline in the quantity of annual publications. In fact, since 2000, output and labor productivity have increased.

[FIGURE 7: Publishing Industries Employment (except Internet) versus Labor Productivity and Output, 1996-2017]

Publishing employment statistics reported in **Figure 7** do not include online self-publishing and the many ancillary tasks such as editing, illustrating, etc. (Bureau of Labor Statistics, 2019a). The difficulty of estimating employment trends in Internet-based publishing is that these jobs are classified within, "other information services" – a category that has been steadily increasing since the early 2000s (Bureau of Labor Statistics, 2019b). Yet suggestive evidence indicates that self-publishing is rapidly increasing: in 2017, self-published titles reached over 1 million (Bowker, 2018), representing 156 percent growth in the number of self-published titles published since 2012 (**Figure 8**). Of all self-published print and eBooks in 2017, 88 percent were published by three platforms: CreateSpace (an Amazon subsidiary, which we explore in the following section), Smashwords, and Lulu. Not surprisingly, people are still writing and publishing, but fewer authors use traditional publishers; many self-publish through platforms.

[FIGURE 8: Online Self-Published Titles, 2012-2017]

4.2.1 Amazon

Since Amazon is the dominant firm in book sales and online publishing, we explore the types of work and methods of compensation that have emerged from the platforms that compose Amazon self-publishing: 1) CreateSpace and Kindle Direct Publishing (KDP) for print books and eBooks and 2) Audiobook Creation Exchange (ACX) for audiobooks. In addition to self-publishing, Amazon has 16 imprints that are structured like traditional publishing companies. **Table 3** presents labor force distinctions within Amazon self-publishing and its ecosystem. Of course, self-publishing is just one corner of the Amazon empire.

[TABLE 4: Labor Force Distinctions in Amazon Self-Publishing]

4.2.2 Direct Employees and Contractors

In 2019, Amazon employed 750,000 people. While the number of employees working directly for CreateSpace, KDP, and ACX is unavailable, as one indicator of employment, we found that in February 2019, there were 506 positions being recruited in departments related to Amazon self-publishing.[17] If we assume that the 506 available positions represents 10 percent of the total staff in Amazon self-publishing, then this suggests that Amazon self-publishing alone directly employs approximately 5,060 persons. Amazon self-publishing job titles, such as Software Development Engineer, Senior Product Manager, Human Resources and Compensation Data Analyst, Video Content Producer, Customer Engagement and Retention Manager, differ substantially from traditional publishing industry jobs. They are typically IT-intensive and require technical skills. On average, direct employees are well-compensated with salaries that range from $54,000 to $160,000 in addition to employee benefits.

Within self-publishing, many of the contract and temporary jobs are in logistics, packing and shipping books, on-demand printing, etc. While the precise number of contractors and temporary personnel is difficult to estimate with the available data, Amazon reported that it hired 200,000 seasonal employees for the holiday season in 2018, which provides a lower bound estimate of the number of contractors used by the firm annually for all of its activities. Moreover, it is worth noting that Amazon established Amazon Mechanical Turk for its own needs prior to commercializing it as a service. The minimum wage for Amazon employees has recently increased to $15 an hour, including part-time, temp, and seasonal workers (Business Wire, 2018), and in the COVID-19 crisis, due to the massive spike in online purchasing, Amazon offered temporary wage bonuses that expired in June.

[17] 323 open jobs in "Kindle Content," 125 open jobs in "Audible," and 58 open jobs in "Author & Publisher Experience."

The other category of contract work that is difficult to measure are the professional contractors, consultants, etc., that receive higher pay for providing specialized services. The difference in compensation between Amazon self-publishing direct employees and both types of contract workers is substantial, despite both being complementary workers to the platform.

4.2.3 Platform-Dependent Businesses

Amazon self-publishing authors are platform-dependent consignment content creators. An author with a complete, formatted manuscript uploads it to the KDP portal and their book is subsequently available through Amazon publishing distribution channels. The author's work, which is created at their expense and published for "free" through Amazon self-publishing, is added to Amazon's book collection – an act of uncompensated, platform-dependent consignment content creation.

Authors using Amazon self-publishing have increased substantially. From 2012 to 2017, the number of print and eBooks published through KDP grew from 131,460 to 751,929 (Bowker, 2018). While the precise number of self-published KDP authors is undisclosed, if we assume that each author publishes four books per year, then 187,983 authors self-published on Amazon in 2017. The increase in self-published titles is likely driven by: 1) authors who previously worked with traditional publishers switching to KDP, 2) authors who previously worked with online competitors switching to KDP, and, almost certainly the largest category, 3) new authors entering the industry and choosing to self-publish with KDP. By providing free tools to build and publish books, royalties of up to 70 to 80 percent of the sales price, and access to top distributors including Amazon itself, Kindle, and Audible.com, Amazon publishing has become a dominant way for authors to distribute their work, thereby disrupting the traditional publishing industry.[18]

[18] If an author earns royalties from Amazon, this income is considered self-employment income in national accounts (Abraham & Amaya, 2019; Allard & Polivka, 2018).

4.2.4 Prosumer-Generated Content

Once a book has been published on Amazon's marketplace, customers, through their perusing, buying, and commenting generate content. In 2017, there were 100 million Amazon prime members, many of whom have likely used Amazon to purchase at least one print book or e-book (Bezos, 2018). Amazon collects data on users' past purchases, wish lists, shopping cart, reviews, and ratings that is used to make recommendations for future purchases and is monetized by the company when the targeted suggestions lead to a purchase. For Kindle books, users have the ability to highlight words and take notes; their annotations are analyzed by Amazon to determine what topics are of interest to users, make purchase suggestions, and even provide feedback to authors regarding what is successful (Wills, 2018). While users are not compensated for their data generation, it creates value for Amazon and helps direct authors toward producing more marketable products.

4.2.5 Amazon Self-Publishing Ecosystem: Platform-Dependent Businesses

There are two types of platform-dependent businesses that arise because of the Amazon self-publishing platform. First, platform-dependent remote service provider jobs. As authors self-publish through Amazon, they independently find editorial services, cover designers, eBook conversion, translation services, etc., for the tasks that authors cannot or do not wish to complete themselves. This is illustrated in **Figure 9**, as these members of the Amazon publishing ecosystem provide services to the authors (Shaughnessy, 2018). This assistance is secured through word of mouth or platforms such as Amazon Mechanical Turk or Upwork. Based on a search on Upwork in February 2019, more than 12,000 freelancers in the US appeared in a search for "book editor," "book translator," and "graphic designer." If we assume that for each book self-published through Amazon, one additional person (aside from the author) was paid in

the process, then in 2017 there would have been at least 751,929 gigs generating income. As one person may undertake multiple gigs, it is difficult to estimate the number of individuals involved. But this ecosystem of indirect complementors clearly has many members receiving income, though their appearance in labor statistics is extremely difficult to trace – and yet, they are clearly dependent upon the platform economy and the work certainly is precarious.

The second category is platform-dependent in-person service providers composed of the couriers that deliver Amazon print books – of course, these are general delivery workers and books are only a small subset of what they deliver for Amazon. These independent contractors work through Amazon Flex, which allows individuals to perform Amazon deliveries using their own car, and are estimated to earn $18 to $25 an hour before expenses (Semuels, 2018). On the Amazon Flex app, workers designate times that they are available to pick up and deliver packages, and are directed and monitored during the delivery process. In September 2018, Amazon announced a pilot program called Delivery Service Partner. This program has expanded massively as Amazon has seeded a massive network of dedicated contractors that have established their own delivery businesses with Amazon providing Amazon trucks, training and on-demand support (Soper, 2020). These dedicated contractors are rapidly supplanting the Amazon Flex operations, because the delivery business owner has greater accountability and there is less threat of the drivers being reclassified as Amazon employees.

Amazon self-publishing demonstrates the profound ways that platforms have changed the publishing industry and fragmented traditional publishing occupations into tasks that platforms absorb, and remaining tasks that authors or others with niche skills complete. This shift may partially explain the steep reduction in traditional publishing employment, even as the number of publications has increased.

5. Data Issues on Measurement

This paper introduces a taxonomy of the complex ways work in the platform economy is being organized and provides case studies as well as suggestive macro-level data on employment numbers. The case studies of Etsy and Amazon self-publishing suggest that there are consistent patterns of work, employment and value creation across online platforms that can be systematically classified into the proposed taxonomy, and are, arguably, measureable. Yet, constraints on available data prevent a complete and accurate estimate of employment in these categories. In this section, we discuss a few of the data issues that arose from our case studies.

In both cases, direct employees are the only category that may be precisely measured from company releases to the SEC, annual reports, and EEO-1 data. However, US firms are not required to provide information on the occupational composition of their workforce, so assessing the changing nature of work with respect to skill requirements, education level, work conditions, and compensation is difficult. In many European nations that have stricter reporting requirements, more accurate measurements of different categories of platform workers may be possible. We use job titles on firm job listings, Glassdoor, and LinkedIn to get a sense of the types of direct employees that platform firms are hiring, but the representativeness of this anecdotal data is uncertain. Although it is well known that most platform firms depend on contractors, these firms do not release data on the number of contractors that they hire at any skill level. Thus, our estimations of contractors is again anecdotal, but the patterns do appear to hold across these platform firms, and given the sensitivity of this category, may be under-estimations. For the platform-dependent businesses category, there are a number of data issues. First, while an individual may create an account, there is no way to verify whether they actually used it or earned income from it. Second, individuals may create multiple or duplicate accounts,

thus, there will be double counting. Third, in some cases (e.g. 1099-K tax form used for analysis in Section 3), there is an earnings threshold that must be met for an individual to be eligible to file. Thus, there is under-estimation of total earnings. For the prosumer category, although the number of users is made public by some firms, it is also likely an overestimation due to multiple or duplicate accounts per user. Finally, our estimates focus on the US, however, since we are focusing on firms that specialize in digital tools in a globalized world where remote work is increasingly common, it is difficult to determine to which country the earnings should be attributed – the platform economy is global in scope.

Many data gaps remain. However, this should be viewed as an encouragement for future research on the subject. A number of innovative approaches have been used to collect data on and approximate the employment effects of the platform economy. For example, in 2018, the Bureau of Labor Statistics (2018a) uses survey data to estimate the size of the workforce doing electronically mediated work of all types. Similarly, Katz and Krueger (2019) use an online survey based on the Current Population Survey questionnaire to measure electronically mediated work. In another study, Abraham et al. (2018) use individual-level survey and administrative records to approximate the gig economy. Kässi and Lehdonvirta (2018) use API access and web scraping to track projects and tasks posted across online labor platforms such as Upwork. Nunu et al. (2018) uses administrative data and big data to assess the size of what they termed the "collaborative economy" to measure revenue and employment. Farrell et al. (2018) analyses JP Morgan Chase customers' bank account transaction data to estimate platform-dependent work.[19] Many of these efforts used quite narrow definitions of the platform economy excluding various

[19] For a comprehensive review of these studies, please see Riso (2019).

types of work, such as, for example, consignment creators or, the many sources of income of influencers.

While the attempts to measure the scale and scope of the platform economy are limited due to data constraints some of which may be overcome through access to national administrative data. As we have shown, more difficult will be to define the scope of the platform economy and particularly those that are indirectly working in these large platform ecosystems that we discussed. For example, should an illustrator that works for a self-publishing author who is a member of the platform economy be counted, despite the fact that they are not directly transacting over the platform and likely to receive a 1099-MISC tax form? If queried in a survey, how would they answer a question about whether they are transacting over a platform, when, in fact, they are not receiving income through the platform. Further, how does one count individuals that receive only part of their income from platform-related activities, or, equally as complex, if they receive income from a number of different platforms. Sorting out the definitional issues will be vital to accurate measurement and understanding the pervasiveness of platform-related economic activity.

6. Discussion

Despite data gaps in our understanding of labor in the platform economy, there are a number of conclusions that we may draw. First, platform ecosystems are a significant driver of labor reorganization and economic transformation. As platforms create new tasks (as in the case of YouTubers or bloggers) and subsume other tasks (as in the publishing industry), work in traditional firms is being reconfigured and a wide variety of new value-creating activities are emerging, though, for all but the most successful, the income could not support even a single individual. In fact, the 2.7 million platform-dependent vendors globally claimed by Etsy suggests

that the most representative estimate of 1.6 million electronically mediated workers in the US economy is a vast underestimation (CPS, 2018). In their current configurations, although much new work and value is being created, the platform's direct employees and some of the most successful content creators capture a bulk of the benefits. Of course, the greatest beneficiaries are investors, top executives with enormous equity positions and stock options.

Second, platform firms *employ* an elite group of workers that create and maintain the platforms. As our data shows, for the successful firms the revenues per employee are among the highest in history and even outstrip the previous era technology giants such as HP, Intel, and Cisco. These direct employees of successful platforms (with the exception of Amazon's logistics employees and Apple sales personnel) receive excellent compensation and are employed in remarkable workplaces. The platforms also hire temporary and contingent workers that have none of the benefits and often far lower compensation.

Third, our taxonomy suggests that platforms are enabling a finer-grained division of labor. For example, in the case of book publishing, the traditional publishing occupation has been fragmented into tasks that the Amazon self-publishing platform absorbs, while orchestrating the remaining tasks that are dispersed to authors and other contractors. The consequences of the finer division of labor on workers' wages and incomes, benefits and worker protections, bargaining power, economic mobility, etc., has been profound. And yet, making definitive general statements is difficult until we more systematically understand and measure the entire ecosystems that platforms enable.

Fourth, we question the notion that digital platforms are, necessarily, labor-reducing. In fact, our data and case studies suggest that there is significant ambiguity surrounding the consequences of platforms for the net number of jobs, or better perhaps, income-generating

activities. While most surveys to-date find that electronically-mediated ("platform") work represents one percent of total US employment – a share so small that it is unlikely to offset any substantial platform-induced task elimination or job displacement (CPS, 2018), we believe that the quantity of people that receive income from platforms is far greater. For example, these surveys do not account for the online-only brands that have emerged in the last few years. Moreover, the estimates of new platform-based economic activity implicitly include only platform-dependent workers who use a platform for full-time employment. They neglect the ecosystem of new economic activities that have grown around platforms (e.g., an Uber driver working 40 or more hours per week would be counted, but a talent agent for YouTubers would be omitted). The taxonomy captures – and the case studies illustrate – the complex ways that platforms are generating, transforming, and reorganizing distinct types of work, employment, and value-creation that the existing literature does not consider.

Fifth, it is important to consider the impact of platforms on work quality. From 1997 to 2016, the share of high-tech employment within the service industry increased by 16 percent (Roberts & Wolf, 2018). Since many platforms provide services, it is plausible that platforms are contributing to and potentially accelerating the migration of high-tech employment into service-providing industries. Occupational restructuring toward high-tech work within the service sector is certainly generated in part from *within platform firms*. It will be driven by the types of workers (e.g. computer programmers, mathematicians) that are directly employed and contracted to create and maintain platforms, as well as from platform-dependent consignment content creators (e.g. web developers) *that are likely to be less well-compensated and more contingent.* On the other hand, a myriad of activity is generated by the *platform ecosystem* that is contingent, with unpredictable demand and pay, highly volatile work hours and income, limited worker

protections and benefits, and job tracks that do not have career ladders. This does not preclude upward mobility, but mobility is likely to be more capricious and unpredictable. The impact of platforms on the income distribution and inequality needs careful examination. For example, Schor (2017) suggests that platforms such as Uber and Airbnb inherently favor individuals that have assets that they can monetize. Indeed, within the platform economy there seem to exist two divergent trends with respect to quality of work that is likely to reinforce the overall occupational polarization in the US economy that began in the 1980s.

Finally, and more generally, it is evident that at the macro level platforms are, in some cases, reorganizing entire work sectors as we saw with Amazon self-publishing. Amazon's hiring in the self-publishing field also was different than what one would expect from a traditional publishing house indicating a shift in skills towards digital. This may be indicative of a more general tendency for domain-specific skills to change as platforms become ever more pervasive in the 21st century economy.

7. Conclusion

Just as factories changed competition and industrial relations, platforms are now redefining the scope of market competition, the organization of industrial relations and work process, and influencing the power arrangements across the economy. In order to address pressing research and policy questions, it is necessary to first systematically identify, classify and measure labor within the platform economy. Our framework provides a comprehensive way to understand the reorganization of work driven by the increasing centrality of platforms to large swathes of the economy. We extend the discussion to not only the direct ecosystem participants, but in the case of Etsy and Amazon, show that these enormous platforms also create indirect ecosystem contributors that provide specialized services to the direct ecosystem members. The

case studies illuminate how the framework opens out the dynamics of work and labor markets in diverse, but significant, platforms. The cases suggest that the dimensions of labor market changes are being both underestimated and misunderstood.

Of course, this just begins the discussion and sets the stage for further research. Our cases find that, aside from the direct employees of platform firms, platforms are not on track to create millions of middle-income jobs as the factory did in the prior era. Rather, platforms are providing the opportunity for individuals to earn income with no benefits or security, and undermining jobs that have historically paid decent wages (e.g. Uber versus the taxi in transportation, Airbnb versus union-organized hotel workers, YouTube versus traditional entertainment, etc.). However, this is not an inevitable outcome. Whether platform-enabled economic activity might result in jobs that are well-compensated for the vast majority of those engaged will be decided in the political realm. For this to be the case, platform-enabled workers would require the bargaining power to capture the value that they create. Already, we are seeing some attempts at collective action by platform-dependent businesses, for instance, Rideshare Drivers United. Finally, some scholars, such as, Trebor Scholz (2016) have argued that platforms could be owned by cooperatives and thus removed from the pressure to constantly increase profits and penetrate new sectors of the economy.[20]

How particular tasks are integrated into the platform and platform ecosystems is a matter of regulatory rules and business strategies. Moreover, the labor market dynamics will vary by firm and sector. For example, Uber, Airbnb, YouTube, the Appstore, and Upwork involve platform-dependent work, but the tasks, labor markets, and compensation schemes in each differ dramatically. Nonetheless, the taxonomic categories and the variation within them, can create a

[20] In agriculture, existing cooperatives have introduced platforms aimed at insuring that farmers have an alternative to for-profit platforms (Kenney et al. 2020).

starting point for conceptualizing the changes in the labor market and economy and motivate research to understand how platforms are reorganizing socio-economic life and designing regulatory structures that ensure that the benefits are shared more equitably.

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Tables and Figures

[TABLE 1: Sample of Existing Classifications of Labor in the Platform Economy, Theoretical and Empirical]

Table 1: Sample of Existing Classifications of Labor in the Platform Economy, Theoretical and Empirical			
Source (ascending by date	*Classification of work in*	*Example*	*Limitation*

of publication)	*the platform economy*		
OECD (2016)	Services delivered physically	Airbnb; Uber	Focus on platform service markets ignores platform goods providers
	Services delivered digitally	Upwork; Freelancer	
Kalleberg and Dunn (2016)	Crowdwork	Amazon Mechanical Turk	Focus on work for "gig" companies, without acknowledging that gig companies employ far more workers than merely gig workers
	Online freelance	Upwork, Freelancer	
	Delivery/home task	Handy, Instacart	
	Transportation	Uber	
Manyika et al. (2016) and Forde et al. (2017)	Dependence on platform-generated income determines status of platform work	Uber, YouTube, Amazon seller	Must be remunerated via platform to be considered a platform worker; neglects variety of labor done via platforms that is uncompensated (e.g. creating a website on Google)
Huws et al. (2017)	Paid work via an online platform ("crowdwork", pg. 16)[21]	Working 'virtually' from their own homes via an online platform, e.g. Upwork or Clickworker	Focus on paid work via an online platform ("crowdwork", pg. 16), which ignores uncompensated labor for a platform
		Providing services via a platform, e.g. Uber	
		Working in somebody else's home, e.g. Helpling, Myhammer or Taskrabbit	
Florisson and Mandl (2018)	The main features of platform work: paid work organized through platforms, three parties involved (platform, client, worker), aim is to conduct specific tasks or solve specific problems, form of outsourcing or contracting out, breakdown of 'jobs' into 'tasks', on-demand services	Uber driver, Amazon seller	

[21] Use a broad definition, including variables: income source, job search, non-standard work arrangement, frequency of work to construct definition and identify "crowdwork" from a survey.

Pesole et al. (2018)	Providing services via online platforms, where you and the client are matched digitally, payment is conducted digitally via the platform and the work is **location-independent**, **web-based**	Upwork	Focus on platform service markets ignores platform goods providers
	Providing services via online platforms, where you and the client are matched digitally, and the payment is conducted digitally via the platform, but work is performed **on-location**	Uber	
Howcroft & Bergvall-Kåreborn (2019)	Online task crowdwork	Amazon Mechanical Turk, Upwork	Classification based on initiating actor (requester-initiated vs. worker-initiated) and type of remuneration, yet only accounts for work directly interdependent via platform
	'Playbour' crowdwork	InnoCentive.com	
	Asset-based services	Airbnb, Uber, TaskRabbit	
	Profession-based freelance crowdwork	App developers for Apple or Google	

[TABLE 2: Platform Economy Categories of Labor Force Value Creation]

	Employment Type	**Typical Firms**	**Compensation Type**	**Labor Conditions**	**Value-Creation Process**
Platform					
Direct Employees	Full time	Google, Amazon, Facebook, Snap, AirBnB, Uber	Salary, stock option, and in-kind remuneration (e.g. access to gym, travel credits)	Excellent	Creating and maintaining platform
Temporary employees	Full or part-time	Dynamex, LeapForce	Salary or by job	Precarious, low- or high-wage	Routinized or specialized
Platform-Dependent Businesses					
Platform-Dependent Vendors	Independent vendors	Amazon, Craigslist, eBay, Etsy	Difference between purchase and sales price	Low wage or precarious	Sales but can include logistics
Platform-Dependent In-Person Service	Contracted service through platform (contested)	Uber, Lyft, PostMates, GrubHub,	Payment by work completion; income by hour	Gig, low-income	Provide service, sometimes monetize asset

Provision		Eldercare.com, Airbnb	worked or gig		
Platform-Dependent Remote Service Provision	One-time project contract	Upwork, Fiverr, Freelancer	Agreed upon by job	Gig, low-income	Project work
Platform-Dependent Consignment Content Creators	Not employed, employed or contracts	YouTube, Spotify, Apple Music, App Store, Google Play; any firm with website	Income from sales or share of advertising	Skewed, with few having large returns; varies	Content creation; building websites for firms
Prosumer	Not employed	Google, Yelp!, Waze, Facebook	Use of platform	N/A	Produce data from which value is extracted

Source: Adapted from Kenney and Zysman (2019a).

[TABLE 3: Etsy Employment by Category]

Case Study: Etsy		
Employment classification	*Examples*	*Estimate of labor*
Platform		
Direct Employees	Managers, software engineers, IT, sales, HR	1,240
Contractor (high-skill)	Programmers, content evaluators, hiring experts	Unavailable, given data constraints
Contractors (low-skill)	Security, custodians, food prep	Unavailable, given data constraints
Platform-Dependent Businesses		
Platform-dependent vendors	Vendors with listings on Etsy	2.7 million
Prosumer	Users' data-generation, user reviews	46.4 million+
Etsy Enabled Ecosystem		
	Economic activity in the supply-chain of Etsy sellers, e.g. warehouse, logistics	14,000+

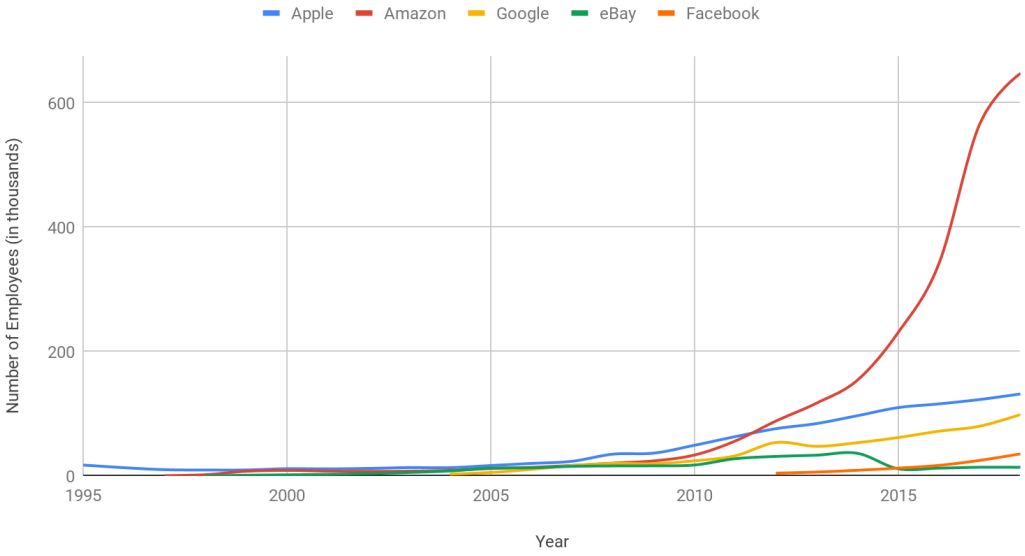
[TABLE 4: Labor Force Distinctions in Amazon Self-Publishing]

Case Study: Amazon Self-Publishing for print books, eBooks, and audiobooks		
Employment classification	*Example*	*Estimate of labor*
Platform		
Direct Employees	Kindle Content Managers, Software Development Engineer	5,060
Contractors	Warehousing, on-demand printers, narration services	200,000+ (Amazon total)
Contractors	Professionals, consultants	Unavailable, given data constraints
Platform-Dependent Businesses		
Consignment content creators	Authors	187,983[22]
Prosumer	Readers and reviewers	100 million+
Amazon Self-Publishing Enabled Ecosystem		
Platform-dependent remote service providers	Amazon Mechanical Turk, Upwork professional to do layout, cover, etc. tasks	751,929 gigs [23]
Platform-dependent in-person service provision	Amazon Flex, Amazon Delivery Partners	Unavailable, given data constraints

[22] This is assuming each author publishes about four books per year. This is the only group that *might* be counted in national account on platform work

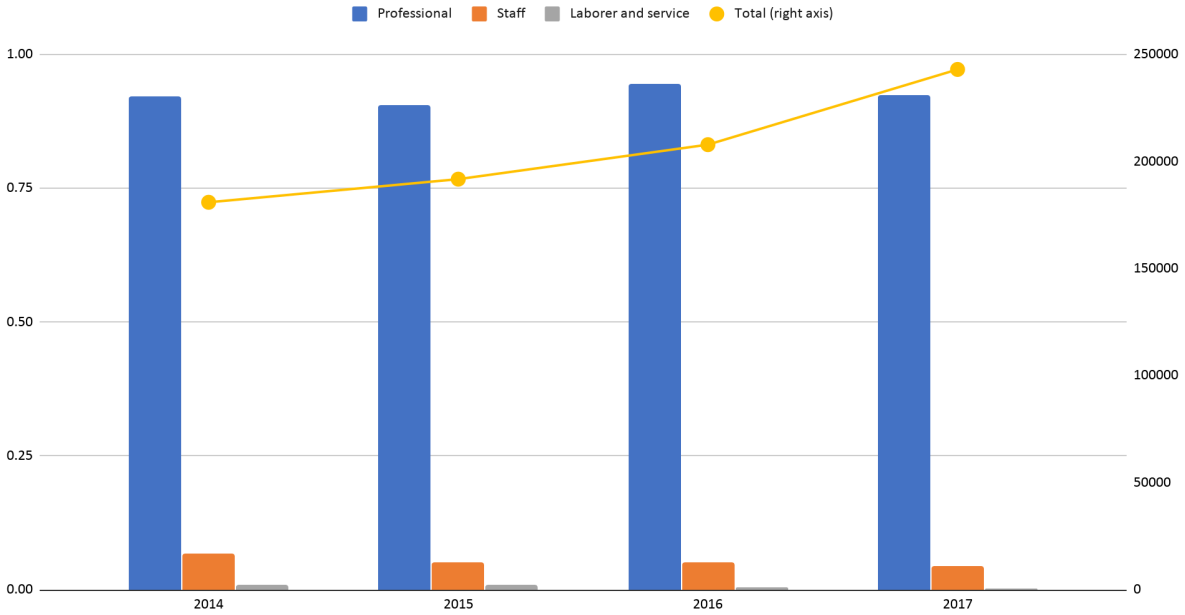
[23] This is a lower-bound estimate, since it assumes that for each ISBN title published through Amazon self-publishing, only one additional person was paid to complete a job in the book creation process.

[FIGURE 1: Platform Firm Direct Employment, 1995-2018]



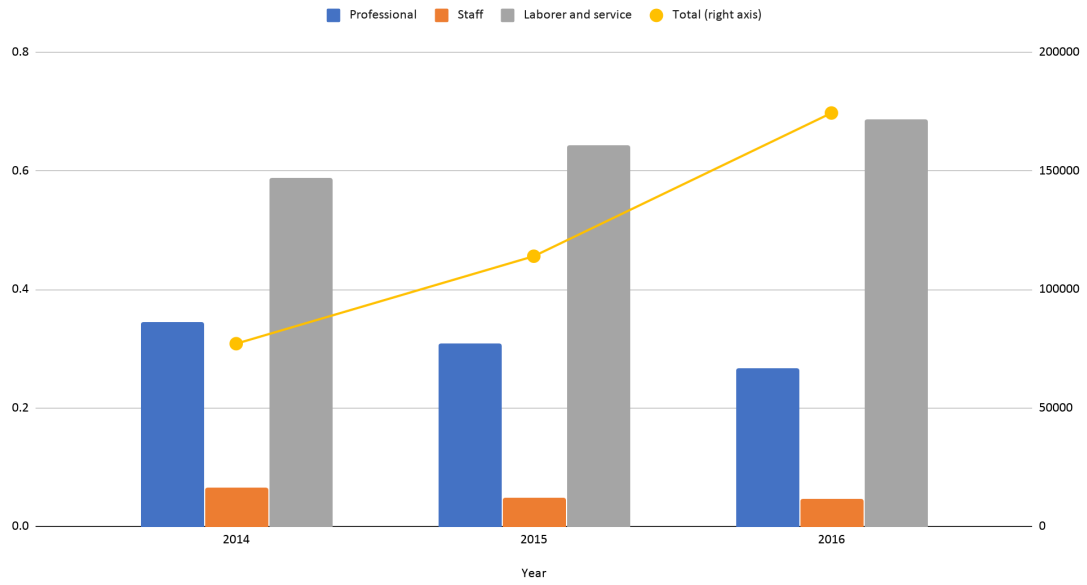
Source: Authors' calculation based on Compustat data from January 1995 to December 2018.

[FIGURE 2: Panel A: Share of Employees by Job Category at Select Platform Firms]

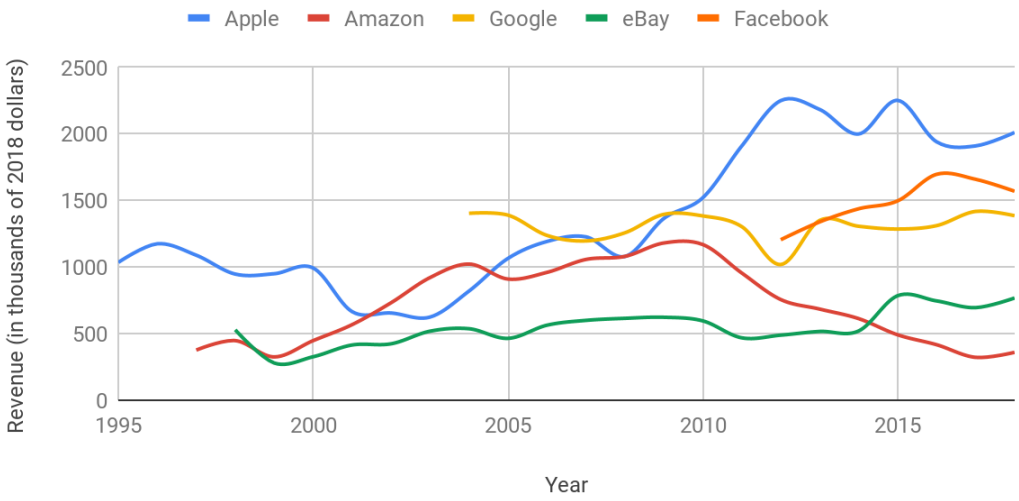


Firms include Facebook, Google, Microsoft, Apple, Airbnb, and eBay. For Google, 2015 data is missing and for Apple 2017 data is missing. In these cases, we assume that the data are the same to the previous year. Source is EEO-1 data.

[FIGURE 2: Panel B: Share of Employees by Job Category at Amazon]

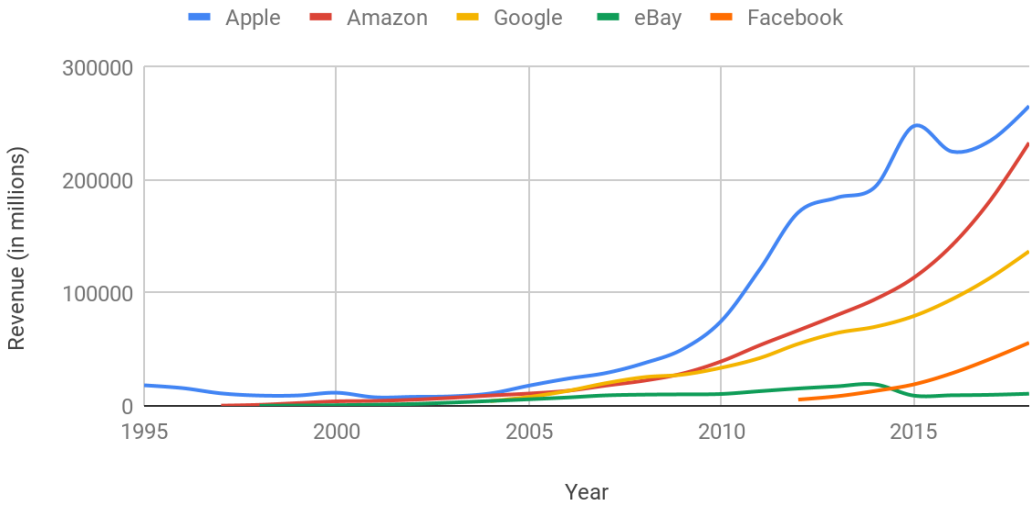


[FIGURE 3: Panel A: Revenue per Employee by Year in Thousands of 2018 Dollars, 1995-2018]



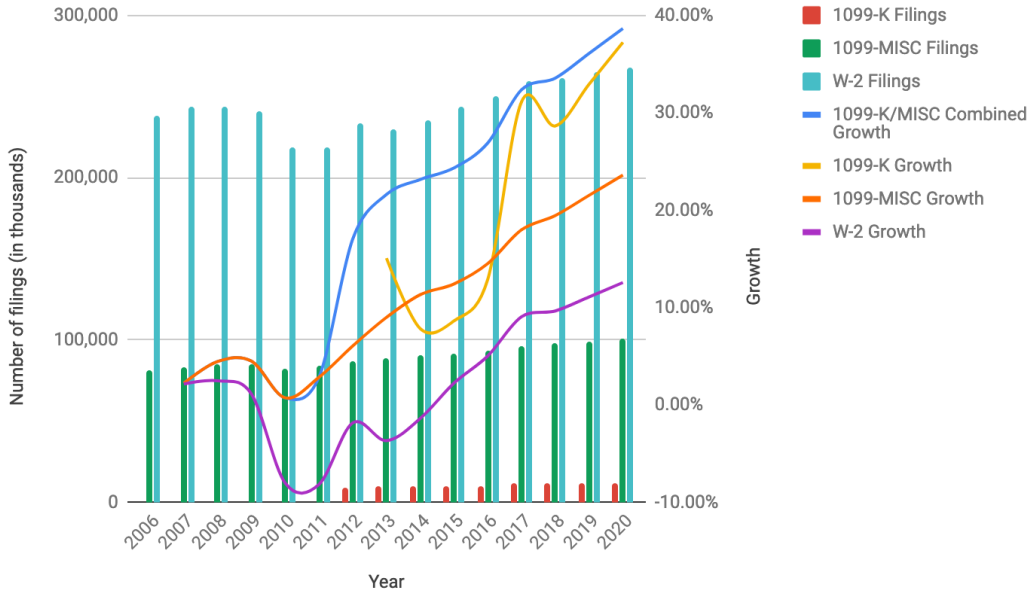
Source: Authors' calculation based on Compustat data from January 1996 to December 2018.

[FIGURE 3: Panel B: Platform Firm Revenue in Millions of 2018 Dollars, 1995-2018]



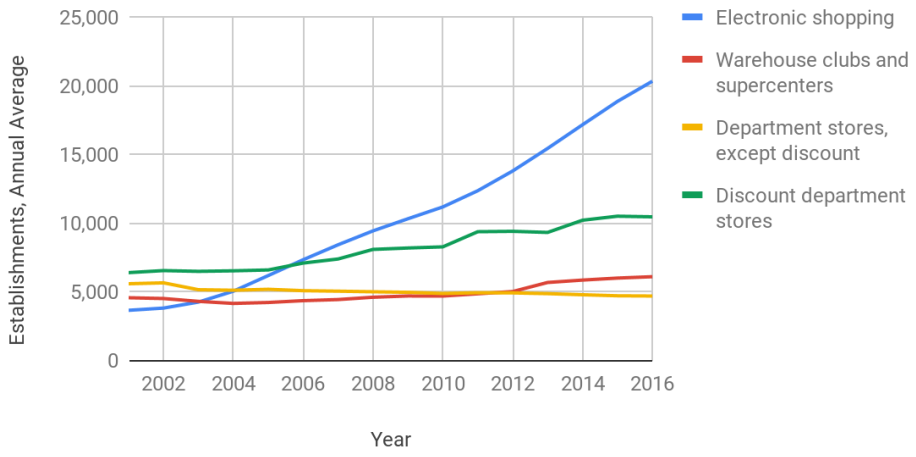
Source: Authors' calculation based on Compustat data from January 1995 to December 2018. Real dollar conversions made using Consumer Price Index.

[FIGURE 4: 1099-MISC/K versus W-2 Filings, 2006-2020]



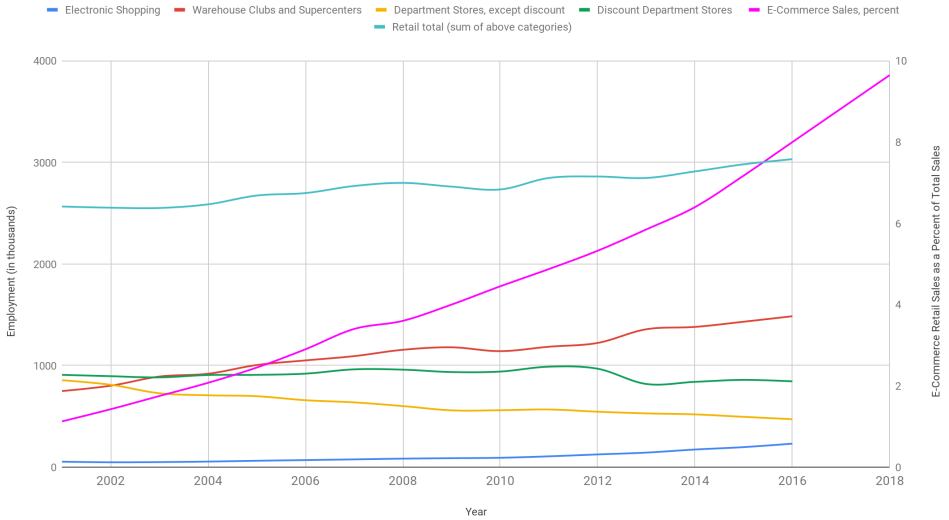
Source: Authors' calculations based on Internal Revenue Service data, Statistics of Income, Annual Publication 6961. Numbers for 2018, 2019 and 2020 are projections.

[FIGURE 5: Number of Establishments in Selected Retail Industries, 2000-2016]



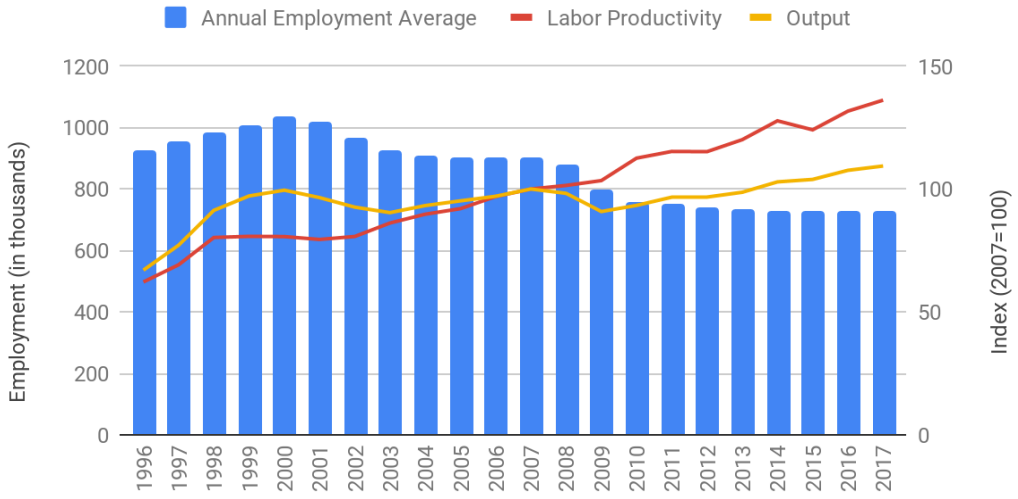
Source: Recreated from Bureau of Labor Statistics data.

[FIGURE 6: Share of E-Commerce Sales versus Employment in Selected Retail Industries, 2006-2016]



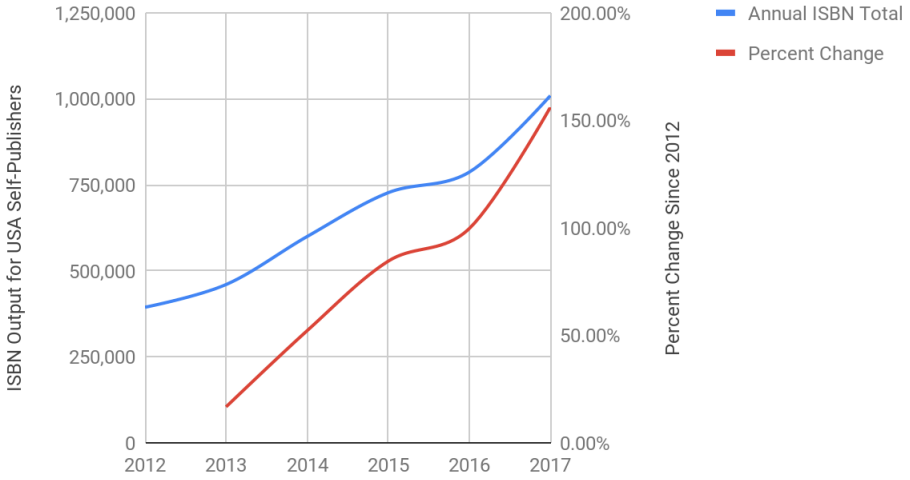
Source: Data on employment adapted from the Bureau of Labor Statistics TED: Economics Daily on electronic shopping (2017). Data on e-commerce sales as a percent of total retail sales from FRED.

[FIGURE 7: Publishing Industries Employment (except Internet) versus Labor Productivity and Output, 1996-2017]



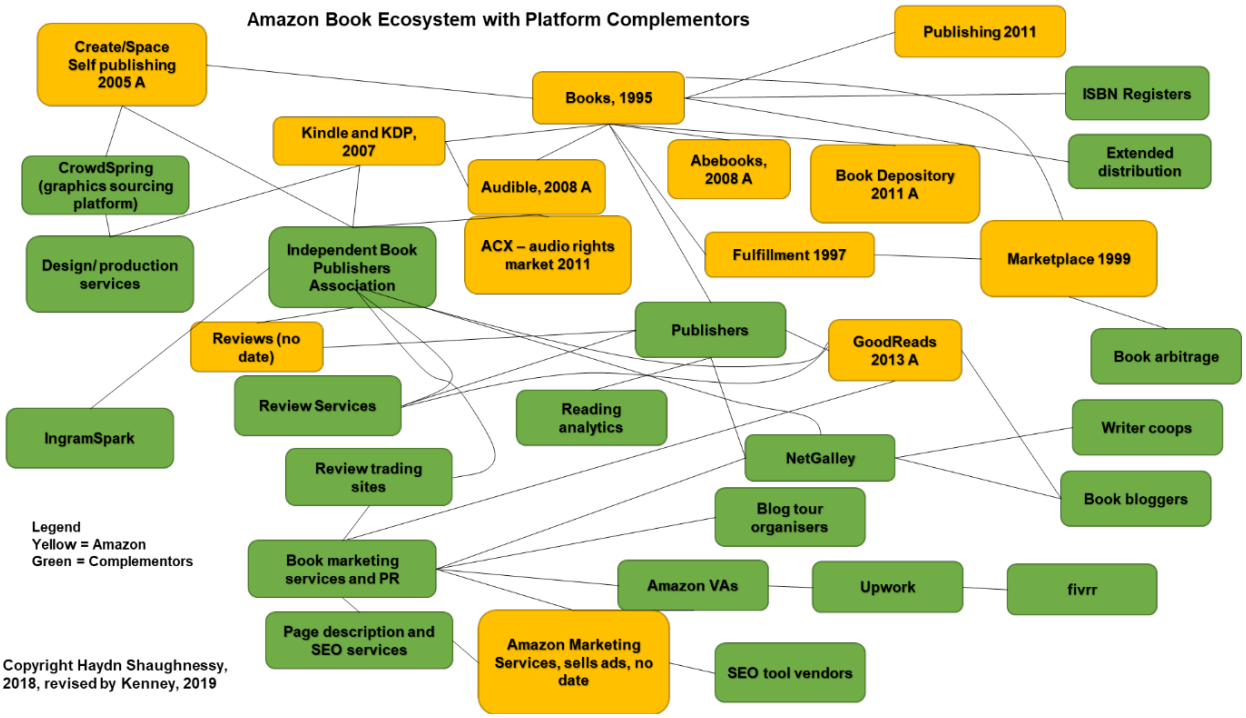
Source: Data from Bureau of Labor Statistics (2019a).

[FIGURE 8: Online Publications, 2012-2017]



Source: Bowker Self-Publishing Report 2012-2017.

[Figure 9: Amazon Book Ecosystem with Platform-Dependent Complementors]



Source: Haydn Shaughnessy (2018) and revised by Martin Kenney (2019).

06/2019 (revised 07/2020)

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