CHAPTER 2

# Information Technology and Wealth Concentration

**Abstract** This chapter describes shifts in private wealth in the United States since 1980, away from real assets toward financial assets, and away from the energy and commodity sectors of the economy toward information technology and finance. We describe how major digital technology companies, despite their variety, share basic similarities in terms of financial characteristics, such as profits, ownership, and a variety of business models. This chapter also explores how the scalability of digital technology affects the concentration of wealth.

**Keywords** Wealth concentration · Changes in wealth · Information technology sector · Financial assets · Scalability

## 2.1 The Great Wealth Shift

With rising income inequality since 1980 came an equally dramatic, if less discussed, shift in the nature of wealth. Piketty includes in his theory both wealth and income inequality, characterizing the relationship between wealth and income as wealth representing the 'weight of the past,' or previous accumulations of income, and income representing the present day. Wealth inequality is even higher than income inequality, as measured by Gini coefficients (Keister 2000). Piketty divides wealth into two types: financial assets, such as cash, bonds, and stock ownership, and real assets, such as housing and vehicles. The two types of financial



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assets differ in their ownership transparency, and how they are usually taxed. The owners of real properties are often easier to identify, and real property tends to be taxed on the full value of the asset every year while financial assets are often taxed only on the gains when an asset is sold.

The US economy since 1980 has been experiencing growing financialization, with a larger percent of the economy and its profits coming from financial activities rather than trade or production. Financialization can be seen in the growing percentage of corporate profits captured by the financial sector, and by the growing percentage of income coming from financial sources in households and non-financial companies (Krippner 2005).

Financialization has brought a shift in US household wealth from real to financial assets. Figure 2.1 summarizes the shifts in US household wealth. According to data from the US Census Bureau, financial assets

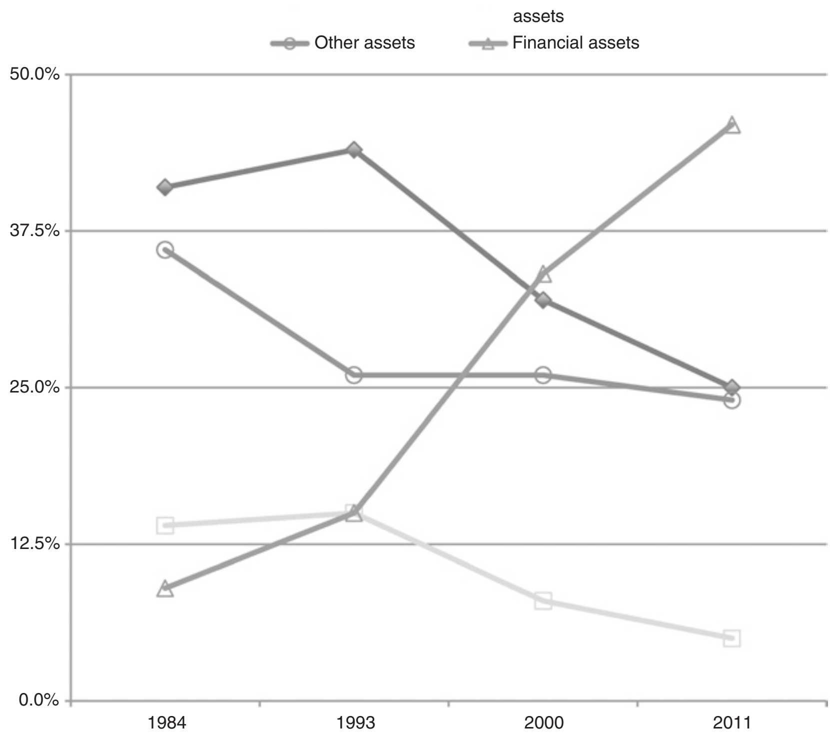


**Fig. 2.1** *IEA* savings, money market, CD, interest checking; *other assets* vehicles, rental properties, business, unsecured liabilities, other. *Source* SIPP, US Census

have risen from 25 to over 50% of median household wealth between 1984 and 2011. Even with the decline of interest-bearing bank accounts, there has been explosive growth in household ownership of stocks, particularly in tax-advantaged retirement accounts. Real estate fell from 40 to 25% of median household wealth in the US during that same period, while the percentage of wealth in other hard assets, such as cars and furniture, has also declined.

The shift from real to financial wealth has underappreciated consequences for economic inequality. Real estate assets, though unequally distributed, are more equally distributed than financial assets, which tend to concentrate in high net worth households. By the 1990s, the top 10% of the wealthiest US households held 88.4% of stocks and mutual fund wealth and 91.8% of financial securities wealth, but only 31.7% of principal residence ownership wealth (Wolff 1998). The bottom half of all US households hold no financial assets at all beyond a small savings account. It is more difficult for the wealthy to escape taxes on real property, and there is greater transparency about asset ownership.

Financial asset ownership in US households is highly concentrated, whether held in private retirement accounts or private business ownership. As corporate profits have increased since 1980 as a percentage of GDP from about 5 to 10% of the US economy (U.S. Bureau of Economic Analysis 2017), a greater percentage of national income has shifted to the wealthiest households through capital gains, dividends, and share buybacks. Over this same period, corporate leaders have increased their emphasis on distributing wealth to shareholders rather than other business stakeholders, such as labor, local communities, or the environment (Jones and Felps 2013).

Changes in financial wealth ownership also interact with ethnic and gender inequality. During the 2007–2008 financial crisis, ethnic minority households in the US were disproportionately affected by the collapse in real estate values (Kochhar and Fry 2014), further concentrating wealth along ethnic lines. The wealth of single earner, female-led households was also disproportionately affected by the crisis.

The growth of financialization, and the shift in wealth toward financial assets, has been controversial. A recent presidential address of the American Finance Association asked whether the growth of the financial sector has been as positive for society as it has been for wealthy investors (Zingales 2015). Critics such as Stiglitz, Mason, and others wonder whether the finance sector is taking over the 'real' economy, encouraging volatility in asset values that the wealthiest can use to their advantage, buying distressed assets at 'fire sale' prices during times of crisis.

Within the shift from real to financial assets, there has been a second important wealth shift since 1980 in the ownership of large corporations, the value of which reflects the growth in profitability and reach of some sectors of the economy relative to others. These wealth shifts represent trillions of US dollars, enough to account for significant changes in wealth distribution.

The wealth contained in the equity ownership of the largest US publicly-traded companies can be divided into ten broad sectors, according to the GICS classification of companies.[1] If we group these sectors into three larger groupings, as shown in Fig. 2.2, a pattern becomes clearer. According to Siegel, the two industry sectors that have grown the most

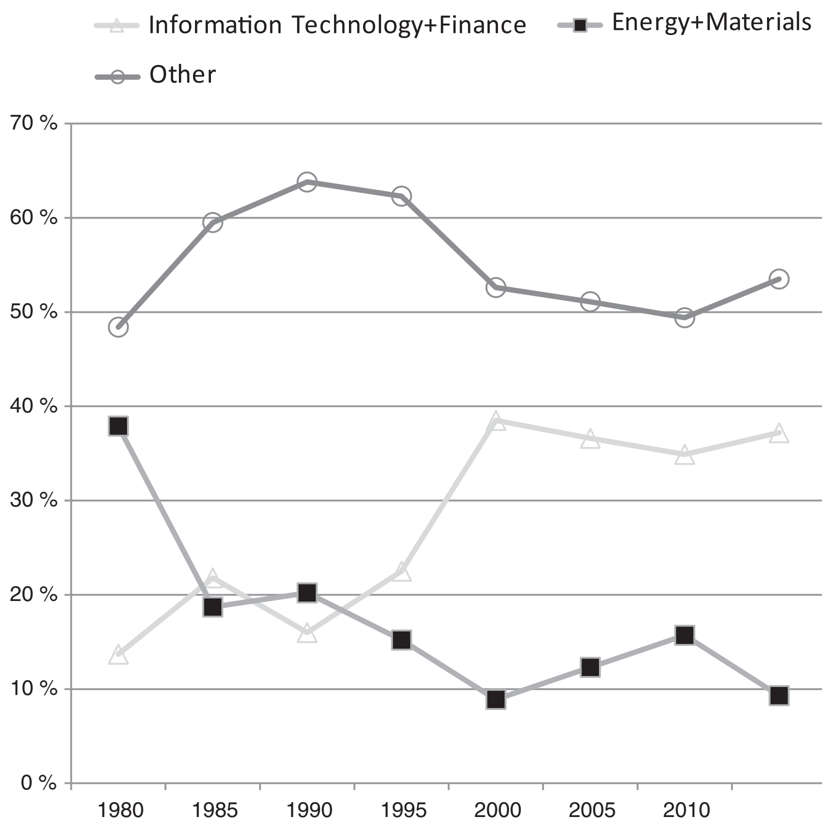


**Fig. 2.2** Market capitalization of S&P 500 by sector type, United States, 1980–2015 (Standard and Poor's 2017)

since the 1980s in terms of financial value are information technology and finance, while the two sectors that have shrunk the most are energy and commodities (Siegel 2005). The two sectors involved in basic physical resources have declined significantly, from around 40 to 10% of market capitalization. The two fastest growing industry sectors, information technology and finance, have grown in proportion by roughly the same amount, the value of the virtualized economy just about swapping places with the value of primary physical production. The remaining other six sectors, if we lump them together as the traditional or 'real' economy, have maintained a fairly consistent value at 50–60% of market capitalization.

In addition to equities, other kinds of financial assets reflect this wealth shift. Corporations around the world have been building large cash and investment stockpiles rather than investing in their own operations or distributing wealth to other corporate stakeholders beyond share owners. As noted above, almost half the total corporate cash stockpile overseas is held by information technology companies.

One way of interpreting this wealth shift would be as a transformation from a more material to a more virtual economy. At the most abstract level, the purpose of both the financial and the information technology sectors is to provide information and services that lead to better decision-making, and resource allocation, in the 'real' economy. Rather than limiting themselves to the role of assistants, though, both the information technology and finance sectors are themselves becoming an increasing share of the economy through their virtualized products and services. Both of these sectors have become the most effective in generating profits and creating financial wealth.

These shifts in wealth since 1980 provide a new lens for exploring the relationship between technology and inequality. What is it about the information technology sector that makes it such a wealth-generating machine? And does this shift in wealth to the information technology sector have a different impact on inequality than wealth concentrated in other sectors of the economy? If there is a wealth concentration effect because of the information technology sector, is it due to some inherent characteristic of technology, as the technological school would lead us to believe? Or is there something distinctive about the way the information technology sector has taken advantage of the institutional context? These wealth shifts could be more about the writing of intellectual property rules in favor of technology companies, or about the favorable taxation treatment they receive, or perhaps because of some previously unexamined combination of the two.

## 2.2 Virtualized Economy: How the Information Technology Sector Is Different Financially

With wealth shifting toward the information technology sector, it becomes important to examine the business practices of large technology corporations. Specific business practices provide a conceptual link between technological capabilities and features of the broader economic environment. Though a technological deterministic argument claims that technology affects the world directly, digital technology is realized through specific business and industry practices.

How are technology sector companies different? Rising equity values, combined with some of the largest cash stockpiles, are both evidence of the unusually strong profitability of large technology companies over time, taken as a group. Both of these wealth stockpiles, equity and cash, confer significant power upon these corporations. They provide the currency to acquire other companies, to hire the most expensive engineers and managers, and to attract the interest of investors in secondary financial markets, such as the stock market. Some of these acquisitions offer extreme examples of wealth being concentrated into the hands of very few investors and employees, such as the multi-billion dollar acquisitions of very small startups, like Instagram and WhatsApp by Facebook. In each case, hundreds of millions of dollars went to a small team of investors, founders, and early employees.

Many of the channels for distributing the wealth captured by large technology companies appear to be highly concentrated. The ownership and management of the high-growth technology firms being acquired by this wealth is concentrated in the richer parts of society, with compensation disproportionately placed in the hands of a small group of managers and engineers. The wealth distributed to shareholders, through rising dividends and share buybacks, also finds its way primarily into the hands of wealthy households. Share buybacks in particular have increased in size to the point where they account for almost all the profits of large US corporations (Wang and Bost 2014), including technology firms. Apple alone has authorized over $150 billion in share buybacks, spending $10 billion on share repurchases in a recent quarter when their total operating cash flow was $11.6 billion (Apple Insider 2016). Clearly, the channeling of wealth to the already wealthy has an impact on inequality.

Low levels of taxation are common for large technology firms. For the institutional context school, taxation policy is one of the key drivers of economic inequality. The real rate of taxation for large technology companies is often lower than other large companies (Kim 2015). As we have seen above, large technology companies can use international subsidiaries to pay less tax on parts of their income than their real economy counterparts. As might be expected, the fraction of assets that are intangible, particularly intellectual property, is high in large technology companies. And intellectual property assets are more effectively used as part of an international tax avoidance scheme than other kinds of wealth (Griffith et al. 2014).

For public technology companies, total compensation or wages might be relatively smaller due to the higher revenue and profits generated per worker, but there is little research to confirm this. Wages in general are high in technology firms, and overall technology sector employment growth continues to grow (Hathaway and Kallerman 2012). Large technology companies use stock options and shares as a larger proportion of compensation than other similar companies (Anderson et al. 2000), which is likely to be unevenly distributed even within the companies themselves. Though beliefs in the power of a key founder or CEO are just as prevalent in the technology sector, there is little evidence that executive compensation is higher in technology companies relative to their size. The largest technology companies are able to generate a large amount of revenue with relatively few employees. For example, employees at Apple, Facebook, and Google each generated more than $1 million of revenue per capita in 2015 (Rosoff 2016).

Technology sector companies consistently have some of the largest profit margins, and absolute profits, of all industry sectors (Chen 2015). Large profits and margins might come from a relative lack of competition, in the most extreme case because of a monopoly position. Are technology companies more likely to be monopolies? Large technology companies, such as Microsoft, Google, and Apple, have faced anti-trust lawsuits and enforcement attempts from governments for decades, but few of those attempts have resulted in an order to break up a monopoly. Despite the lack of anti-trust actions taken by governments, except for fines that represent small fractions of their profits, effective monopoly or duopoly is a feature of many parts of the digital economy, including search engines, social media, personal computer operating systems, and mobile device operating systems. Even newer markets such as sharing economy hiring sites, and online retail sites such as Amazon, appear to be headed toward further market concentration. The network effects of digital technology may naturally encourage monopolistic wealth concentration.

Not all digital technology companies are large enough to be in the S&P 500. There are at least two different types of small and medium-sized enterprises (SMEs) that are technology startups. One type is technology intensive, high growth, and backed by high-risk investors such as 'angels,' or venture capital. Another group of startups is more 'mom and pop,' consisting of small independent contractors with few or no employees, for example a local sales and support business. For technology-intensive, venture-backed companies, there appears to be a wealth concentration effect in which members of a small founding team each stand to make multi-millions, or even billions, with the right acquisition or public share offering. The number of key employees with stock options is relatively small. Much of this wealth will flow to a small group of people. Investors in high-growth technology companies tend to be wealthier, and in some countries are required to have a minimum net worth in the millions of dollars before they can invest. With institutional investors comes the promise of a more equitable sharing of wealth created by the technology sector, but financial asset ownership is still fairly highly concentrated in the broader economy.

For the smaller, slow-or no-growth SMEs, there is a lack of data on their wealth concentration effects. While studies suggests the birth rate of high-growth technology startups is declining (Haltiwanger et al. 2014), and overall startup formation is declining in advanced economies such as the US (Haltiwanger et al. 2015), we know little about new business formation for this more common type of SME. We also don't have much evidence about the effect the technology sector has on wealth concentration in other industry sectors, beyond a general recognition that digital technology investment is broadly associated with increases in investment return (Mithas et al. 2012). The best hope for inequality reduction through the technology sector might be by encouraging opportunity in other sectors. Perhaps the rise of online shopping allows small retail businesses to play on an equal playing field relative to large retailers, or local micro-entrepreneurs could effectively compete in the hotel industry with multinational chains through platforms such as Airbnb.

## 2.3 Value Creation and Value Capture in the Information Technology Sector

The distinction between value creation and value capture has been essential in entrepreneurial and strategic thinking (Teece 2010). Value creation is the set of activities that transform a combination of resources and capabilities into a product or service that has a value higher than the total cost of production, whereas value capture is the ability to realize that profit through specific activities performed by the customer. Inventors may create something wonderful and new, which is the value creation piece of the puzzle. But history is filled with examples of inventors not benefitting financially from their successful inventions, which is the value capture side. Sometimes this is a deliberate choice, as in the case of the World Wide Web, which was freely shared with the world. At other times, the inability to profit from one's own inventions is due to luck, subterfuge, or being outmaneuvered, with cases such as IBM or Xerox PARC versus Microsoft or Apple from the Personal Computing era often mentioned as prime examples.

In many ways, value creation and capture can be seen as the core problem of entrepreneurship and strategy. New value creation depends on invention, but value capture requires something more. From a wealth-generating perspective, there must be a realistic mechanism through which value creators can benefit from their labors.

The value creation capabilities of information technology are many and varied, and have been growing over time as measured by pure technical performance. Digital technology hardware has been improving at an exponential rate for decades, as predicted by Moore's law in the 1970s (Mack 2015), and the progress surprisingly continues. Digital storage and networking power also continue to increase, opening new possibilities for creating valuable products and services. Digital technology has improved to such an extent that Christensen argues technological capability has surpassed what companies and consumers can use effectively, a phenomenon he calls 'performance overshoot.'[2] Laptops and mobile phones can execute billions of instructions per second, much more power than most people need for their everyday uses, such as writing a text message or looking at a web page.

However, this surplus of raw digital power seems to be finding new uses. New artificial intelligence applications, rather than relying on elegant theories and sophisticated understandings of how the world works, are instead relying on brute force power and huge data sets to come up with answers. Speech recognition, vision processing, big data analysis, and autonomous vehicles are just some of the most current examples of digital technology's potential to create new value through massive processing power and large data sets.

Beyond the underlying hardware of digital processing, storage, and networking, we also have the value creating capability of software. Modern software provides a vast set of building blocks for others to build upon, as giant code bases such as the Linux kernel combine and condense millions of programmer hours of effort into a resource that others can freely use and build upon. The rich universe of application software continues to grow in power and usefulness.

For Teece and others, value capture can happen in different ways. The most straightforward method is to sell a product or service. But when a particular product or service is easy to copy or use for free, direct sales may not be the most effective option, as many an entrepreneur has discovered when their new invention was copied and sold by other parties. One of the most fundamental forms of value capture in these circumstances is intellectual property protection Copyright and patent licensing are commonly used value capture models in the technology sector that have advantages over trying to directly sell a product.

Another popular method of value capture is through complementary assets, or by selling products and services that combine with something else made available at low cost, or for free. For digital technology, it is sometimes easier to sell the hardware rather than the software, or to sell a networking service rather than the content available on that service, where one part of a combination can be subsidized or given away for free while other parts are sold.

The value captured can then be shared across the different parties that collaborate to create value. For example, an app store could share a percentage of sales with the software authors, and keep a percentage for themselves. Value can be created by other groups, even the users themselves. An online fan site could make a product more attractive and valuable, or an online discussion group could answer support questions. The value created by users could be shared with them directly, for example by giving resources to user groups and clubs, or the value could be kept inside the company, for example if user discussion groups are used as a substitute for paid product support.

In addition to value creation and capture, the other key concept connecting technology and wealth is the concept of a business model. The business model is a conceptual understanding, or a hypothesis, of how value creation and capture happen (Teece 2010). The business model is implemented, and then tested against reality. Business models that do not fare well can, at least in theory, be experimented with and improved.

What is new with digital technology is the sheer variety of possible business models, along with more powerful ways of testing the viability of those models. As a famous example, consider the Google search engine. Through their unique algorithm that uses web page links as votes for the quality of web pages, Google was able to create value: a search engine that returned better, more relevant results than anything that came before it. But what should the business model of search technology be? Sell web searches as a subscription service? Sell advertisements that appear next to search results? Sell preferred results in a web search, allowing paid results to be shown first? Or sell consumer information about searches to third parties? Or some combination of all of these?

Other search companies eventually copied the techniques that led to superior search results, but none were able to match Google's successful business model, which successfully combined a number of elements. First, their search engine returned two sets of results, the most relevant 'organic' results, and a set of paid results offered by advertisers. Keeping these two sets of results separated increased the credibility of results, and even the paid results maintained a level of quality by using a unique selection method. The advertisements that generated the most revenue through user clicks, and thus were perceived as useful, were displayed at the top of the paid results rather than advertisers who had paid the most. This model led to more clicks, better results, and maximum revenue for Google. Combined with a self-service advertisement creation and bidding technology, the Google search engine model continues to be wildly profitable. The vast majority of revenue for Google's parent company, Alphabet, continues to be paid search advertising. Google has added to the business model a sophisticated advertising network, which skillfully matches its inventory of advertisements to another large inventory of online publishers.

After a long development period without any revenue streams, Facebook also settled upon self-service advertising as their main business model. Their business model includes conventional advertising, and, additionally, an ability to promote status updates and other content through social networks. The model has become extremely profitable, with businesses now in the position of having to pay Facebook in order to communicate with their own followers. The Twitter platform has also experimented with sponsored content as a business model, but with less dramatic financial success.

Apple and Microsoft, in contrast, stick mostly to the business model of sales. Apple sells its digital hardware at profit margins upwards of 50%, while mostly giving the complementary asset of software away for free. The hardware sales would be nowhere near as profitable, however, without the seamless user experience that brings Apple hardware and software together in an easy-to-use combination. Though mostly using sales, Apple does experiment with other business models for different product lines, such as subscriptions for online 'cloud' storage services, and some of their business models change over time, such as digital music which is moving from sales to a subscription model.

The Microsoft model is predominantly to sell systems and application software, relying on other companies to produce the complementary hardware to run the software effectively and cheaply. Where as software companies might have difficulty competing with free, unauthorized copies of their own products, digital software providers can switch to a business model of charging for complementary services, and even tolerate certain levels of privacy in limited markets to generate demand and market share.

Still other digital technology companies pursue a transaction model, which charges a percentage fee every time buyers and sellers are matched. In the new sharing economy, Uber and Airbnb use this model to match consumers and service providers, taking a substantial cut of every transaction. In these cases, companies charge up to 20–30% simply for being the matchmaker, and can modify the percentage in real time depending on market conditions. Large technology companies, too, are eager to pursue a mix of business models. Apple charges up to 30% for purchases in their app store, which cost very little to deliver.

Technology companies constantly experiment with different business models to find the best financial results. The career-oriented social network LinkedIn has multiple revenue streams, charging for job advertisements, sending messages within their network, and for premium services to hiring companies. Other digital companies such as Netflix have found new models for existing businesses, in this case using a subscription model for movies instead of purchases or ticket sales. Overall, it appears technology companies are able to experiment, and potentially succeed, with new business models in more traditional industries that have faced financial challenges, and that digital technology companies have the freedom, capability, and creativity to find new business models. This flexibility has allowed technology companies to become masters of value capture in ways other institutions have traditionally found difficult to compete against. There is constant experimentation, both in terms of the business model technology companies choose, and also in terms of the variables used. How much commission should they charge? What should subscription fees be for different types of subscribers? How much should be charged to expose users to different kinds of content? Digital technology companies have the data, and the ability, to experiment with their offerings. Companies such as Netflix are running thousands of experiments per day on their own customers trying to optimize business results (Urban et al. 2016), with such precision that even the image to click on for watching a movie is constantly being experimented with. At what point does a mastery of value capture become a mechanism for concentrating wealth?

## 2.4 The Scalability of Information Technology and Wealth Concentration

Scalability is the ability to grow in size or scope quickly and at low cost. Scalability is one of the most pronounced features of digital technology, thanks to the Internet technology infrastructure that has penetrated many parts of the globe. Eighty percent of the developed world has Internet access, with 50% of the entire world projected to have access by 2020 (International Telecommunication Union 2016). Internet-enabled mobile phones have swept the globe, leading to greater than 100% penetration rates in parts of the developed world.

With a global technology infrastructure, digital technology becomes easy to scale. Digital infrastructure is physical, but it is also based on common standards, protocols, and software. When operating system software becomes widely shared, programmers gain the ability to execute code on millions, or billions, of devices around the world, and because operating system software tends to form monopolies or duopolies, application software is that much easier to scale.

The Internet provides the most powerful example in human history of a common standards base providing the infrastructure needed for scalability. With the common set of services built around the open TCP/IP protocol, the Internet provides a generic, low-cost data communication and transportation system. With some notable exceptions, the Internet provides a level playing field for these services, not giving communication traffic priority to large companies and institutions over small companies and individuals. With a working connection and a valid IP address, the global Internet does all the work of moving data around the world, whether one is a giant corporation or a hobbyist in a garage. This is a huge burden lifted from anyone who wants to write software, or offer a digital service, that can serve millions or billions of people. The most notable exceptions to this level playing field are the state actors who control and monitor an increasing fraction of Internet traffic.

The scalability of digital technology has manifested itself in the low-cost cloud computing movement. Students or startups can launch their code in the cloud at an extremely low initial cost, using the same advanced technology infrastructure available to the largest corporations. As the number of customers increases, the costs and complexity serving them increase only gradually (Armbrust et al. 2010).

The scalability of the digital world is also related to the modularity of information technology. Software design offers the possibility of breaking problems or products into smaller parts then recombining them. When software is made openly available, it becomes easier to build on top of the work of others rather than forcing programmers to recreate every solution on their own. Software modularity makes it possible for thousands of volunteer programmers to coordinate themselves, each working on their own piece of the problem and combining them later. With software scalability, small groups of programmers can create sophisticated products quickly and achieve a global scale. When Instagram was acquired by Facebook in 2012, 13 employees had created a service in less than 2 years that served 30 million users (Luckerson 2016). The Internet, software tools, and the availability of app stores made this level of scalability possible.

We know the scalability of the digital world relates to wealth inequality in at least two ways. First, it brings to life the superstar dynamic in which a few superstars can offer the best mobile app, the best song, or the best video on a massive scale. If consumers are only willing to choose the absolute best, then, theoretically, this should lead to wealth concentration for a few top performers or creators. The superstar effect, however, appears to be somewhat uneven so far. There are segments of the book and music industry where only the biggest stars sell products and make a living from their content directly, whereas in other areas, such as university lecturers, the superstar effect has yet to take hold. The theory of where and when digital superstar effects arise in digital content and software still requires further investigation.

A second mechanism for scalability leading to wealth concentration is through automation. The knowledge or skill needed to perform a task can be captured once, encoded into software instructions, then copied and delivered at extremely low cost. Technology has extended the scope of automation in ways beyond what we recently imagined possible, such as with autonomous vehicles and voice recognition. Frey and Osborne (2017) famously calculated that almost half of all jobs were at risk of being automated in the near future.

The best evidence for automation comes from the professions that have already been severely reduced in size, such as travel agents or paid journalists. Compared to the number of new jobs created in technology-related fields, the fear is that new jobs will not be plentiful enough, or will require expensive skills or rare aptitudes to fill. The limits of automation can still be found in jobs where the knowledge required is not explicit enough, or involves some level of physical skill. However, speculation about AI and robots in the future, even the near future, cannot account for the last 40 years of increasing wealth inequality.

The relationship between digital technology and wealth concentration is more clearly seen in the business practices of the technology sector and the resulting wealth shifts than in the more abstract arguments about automation and superstar effects. Regardless, there are many pathways to wealth concentration in our new digital world. In the next chapter, we take a closer look at the business models replacing markets with digital platforms, a model at the center of many of the largest technology companies.

## Notes

1. The GCIS classification added a new 11th sector, Real Estate, in 2016. This sector was previously a part of the Finance sector. We use the older 10 sector classification for historical consistency.
2. What Christensen called a 'performance overshoot' (Christensen 2013).

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