Demary, Vera; Rusche, Christian

**Research Report**

# The economics of platforms

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Forschungsberichte aus dem
Institut der deutschen Wirtschaft

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Vera Demary / Christian Rusche

INSTITUT DER DEUTSCHEN WIRTSCHAFT

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PO Box 10 18 63, 50458 Köln
Konrad-Adenauer-Ufer 21, 50668 Köln
Telefon: 0221 4981-452
Fax: 0221 4981-445
iwmedien@iwkoeln.de
www.iwmedien.de

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# Contents


**Abstract** 4

**1 Introduction** 5

**2 Foundations of digital platforms** 6
2.1 Definition of digital platforms 8
2.2 Network effects 9
2.3 Critical mass frontier 11
2.4 Determinants of market power 14
2.5 Classification of digital platforms 16

**3 The importance of digital platforms** 22
3.1 Digital platforms among unicorn companies 23
3.2 The importance of digital marketplaces 29

**4 The market behavior of digital platforms** 30
4.1 How digital platforms change markets 31
4.1.1 Market structure 31
4.1.2 Competition and antitrust 35
4.2 Pricing strategies 39
4.2.1 The subsidy side and the money side 39
4.2.2 Monopolistic and competitive pricing 41
4.2.3 Price discrimination 45
4.3 The importance of data 48
4.3.1 From data to information 48
4.3.2 Antitrust concerns 52
4.4 Transparency 55
4.4.1 Transparency between users 55
4.4.2 Transparency between platform and user 57

**5 Policy recommendations** 60

**References** 63

**Zusammenfassung** 69

**About the authors** 71

# Abstract

Digital platforms already dominate the top 10 of the world's most valuable firms. The specific characteristics of their business model, such as quick growth and market power soon after market entry, have provoked public discourse. This paper analyzes digital platforms' business models, the reasons for their success and the challenges they present. Digital platforms offer an online forum for conducting transactions and therefore are able to dramatically reduce transaction costs, which creates value for platform users. Generally, digital platforms are aware of the high and increasing importance of data. By collecting and combining data from the different user groups, digital platforms are able to improve their service for existing users and to attract new user groups. Digital platforms' market power and their control over large, valuable sets of data have attracted the attention of regulatory authorities and led to investigations and fines. Economic policy should aim to protect consumers while still fostering the digital platform business model.

# 1 Introduction

In 1982, John Naisbitt introduced the term “megatrend” to distinguish slow but comprehensive transitions that have an effect on society as a whole from developments that are only transitory (Naisbitt, 2015). Megatrends may give rise to other smaller trends, but they are the driving force for change and, once identified, allow for strategic planning. The number one megatrend at the moment is digitalization, which has been influencing society for decades and will continue to do so for some time to come. This overarching phenomenon (Demary et al., 2016, 4) has given rise to digital platforms such as eBay, Facebook and Google Search. Such platforms dramatically reduce search and transaction costs and therefore increase the number of transactions between economic subjects. The idea behind such platforms is not new though. Since ancient times there have been recognized market places where people have agreed to meet and barter and thus reduce search and transaction costs (Evans/Schmalensee, 2016, 199). Due to advances in technology and the establishment of the internet, digital platforms can now supplement such places.

In times of rapid change due to digitalization, companies increasingly face the question of whether and how to adapt their business model accordingly. Digital platforms are a business model that serves as an example for many companies. At the same time, policy-makers, companies and the public view the platform business model with skepticism or even anxiety. The main reasons for this are their fast growth, which can result in considerable market power, and how they deal with data and transparency. In some cases in the B2C (business-to-consumer) sector, there is also an increasing societal reliance on such businesses (OECD, 2017, 127).

Because digital platforms are in many cases a successful business model, policy-makers debate whether the whole economy is being platformized and, if so, what this means for established companies and society in general. Germany offers many prominent examples of such controversies (e.g. BMWi, 2017). However, by treating the platforms as a new phenomenon, the public debate largely ignores economic theory on the platform business model, which has been the subject of research for some considerable time. EU authorities are

currently using the existing antitrust framework to investigate instances of alleged market abuse involving digital platforms and have already settled some. Still, stricter regulation of platform businesses seems imminent in many sectors and countries.

Against this backdrop, this study aims to shed light on the economic theory behind the digital platform business model. It explains how it really works, where its shortcomings are and how European policy-makers should deal with them. Since most of the current public debate centers on digital platforms that involve end consumers, this study focuses on these business models. In general, the platform business model encompasses a large variety of different business models, sectors and markets. Therefore, the aim of this study is to provide a general overview of digital platforms.

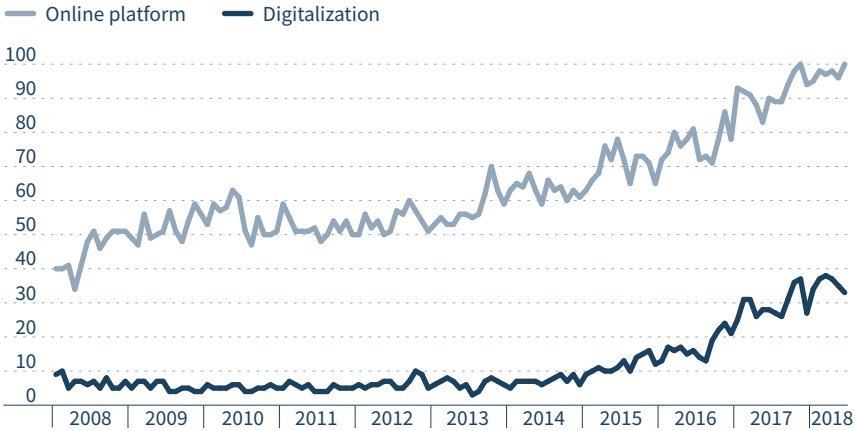
We organize the rest of this study as follows: Chapter 2 provides economic background on how the platform business model works. It also suggests a classification of digital platforms. Chapter 3 presents data on the importance of this type of business model in two settings: among so-called unicorn companies and with respect to online marketplaces. In Chapter 4, we analyze the market behavior of digital platforms with respect to competition, pricing, data and transparency. The focus is on economic insights into market conduct. Chapter 5 concludes with policy recommendations that are valid at the EU or the member state level.

# 2 Foundations of digital platforms

The global interest in digital platforms is high and even increasing. Using Google Trends data as a proxy, the rise in searches for “online platform” within the last ten years is obvious (Figure 1). The term “digital platform” yields similar results at a lower level. Generally, users are likely to search for “online platform” in particular in combination with a good or service they are interested in. Searches for “online platform” therefore to some extent reflect the desire to find and use such a platform. From the beginning of 2008, the number of such search queries rose constantly and reached its preliminary maximum at the

**The significance of online platforms** Figure 1

Google worldwide search queries for "online platform" and "digitalization" since January 2008, maximum = 100, as of June 2018




Data: http://link.iwkoeln.de/398185
Source: Google Trends

end of the observation period, in June 2018. And the general interest in digital platforms can be expected to increase further (Demary, 2016, 4). For comparison, Figure 1 also includes searches for the term "digitalization". While there are relatively fewer queries, the number of searches has risen since the beginning of 2015 as well.

However, compared to searches for a specific platform enterprise (such as Facebook or Airbnb), the searches for both "digitalization" and "online platform" are negligible. Accordingly, the importance of, and the interest of users in, digital platforms is understated in Figure 1, since it neglects the enormous popularity of specific platforms.

The increasing public interest in digital platforms has gone hand in hand with their economic success. Of the 100 most valuable firms worldwide as of December 2017 (EY, 2017), the first five are Apple (with a market capitalization of US$876 billion), Alphabet (US$733 billion), Microsoft (US$661 billion), Amazon (US$570 billion) and Facebook (US$516 billion). For Alphabet, Amazon and Facebook, their digital platform constitutes their unique selling point: Alpha-

bet's platform facilitates both general online searches and advertising; Amazon's is an online marketplace; Facebook is a platform for social interaction. Apple also generates large profits from its platform offerings, such as iTunes and the iPhone app store. Depending on the definition, operating systems such as Microsoft's Windows or Alphabet's Android are also classified as a platform (Bundeskartellamt, 2016, 7), as are gaming consoles like Microsoft's Xbox. Thus all of the top 5 companies specialize in digital platforms, often among other ventures.

The following section lays the basis for the further analysis of digital platforms by providing a comprehensive definition. It then focuses on the most important characteristics of the platform business model and finally suggests a way of classifying different digital platforms.

## 2.1 Definition of digital platforms

There is a huge variety of business models that can be summarized as platform business models. One reason for this is that there is no common definition of what a platform is. Still, there is a common idea of what a platform does: It offers a place or forum where transactions can take place. Accordingly, some economists argue that even a single firm is a platform (Rochet/Tirole, 2006). This concept still includes all platforms, not only the digital ones. Even a weekly produce market is thus also a platform.

While platforms in general are not a new phenomenon, digital platforms exhibit certain unique characteristics that are responsible for the discussion surrounding the platform business model (e.g. BMWi, 2017). That is why this analysis focuses on digital platforms.

There is no widely accepted definition of digital platforms. For our analysis, following Demary (2016, 4), we therefore define digital platforms as follows:

A **digital platform** is an enterprise that uses the internet to facilitate economically beneficial interactions between two or more independent groups of users.

Note that we summarize by this definition a phenomenon that is called a two- or multi-sided market (e.g. Luchetta, 2014), two- or multi-sided platform (e.g. Hagiu, 2007), platform (Bundeskartellamt, 2016) or matchmaker (Evans/ Schmalensee, 2016) in other publications.

Hagiu (2007) stresses that the term two-sided platform implies that the business enables affiliated sellers to sell directly to affiliated buyers. If an enterprise buys products from a producer and sells them to a consumer, it is not a platform, but a merchant. Following this approach, the definition of digital platforms in this paper requires that the platform not be a transaction partner in the facilitated interaction. Therefore, a platform business model usually is asset-light (Demary, 2017, 5). Airbnb, for example, does not own the accommodations it offers for short-term rental, but only facilitates the transactions between potential guests and hosts.

A digital platform is a so-called digital business model. These comprise all companies that facilitate use of the internet or digitalization in general to serve their customers. In addition to digital platforms, this group covers businesses such as online shops, web portals and the like. Since digital platforms exhibit very specific properties, it is useful to find a terminology for all other companies. This allows a comparison between digital platforms and the other group. We call this latter group 'traditional companies' to emphasize that these business models are quite common and have been around for a long time. Hence, traditional companies are all businesses except digital platforms.

## 2.2 Network effects

The definition of digital platforms put forth in the previous section also requires users on all sides to benefit from using the platform (Demary, 2015, 4). If they did not benefit, they would not use the platform and no transactions would be facilitated by it. Besides the direct benefit of the product or service, network externalities contribute to the benefit for the users on the different sides of a digital platform. Network externalities – or network effects – arise when the benefit of a good or service for one user depends to some extent on the number of other agents consuming the good or service (Katz/Shapiro, 1985). Since there are at least two different groups of users, their benefit might depend on

- the number of users in the same group (within-group effect),
- the number of users in the other group(s) (cross-group effect),
- a combination of both.

Unfortunately, there are no commonly accepted definitions for these effects (Bundeskartellamt, 2016, 9 ff.). For our analysis, we define them as follows:

- **Direct network effect.** If a user's utility from using a platform depends on the number of users in the same group, there is a direct network effect. If the utility increases with the number of users in the same group, it is a positive direct network effect. People interacting with their friends or colleagues in social networks are an example of a group that exhibits positive direct network effects. Negative direct network effects occur if a user's utility decreases with the number of people in the same group. Online dating platforms would be an example of this. The more people there are on one side, the higher is the competition for a match with the other side and the lower is the benefit for a user on the initial side.

  Furthermore, we also define a network effect as a direct effect if increased participation on one market side allows the platform to improve its service. An internet search engine can adapt its results on the basis of the data of its users, for example. With every search query, the platform increases its knowledge about suitable results for a given search item. It also improves its knowledge about that user. Accordingly, the search engine is able to improve the search mechanism and place particular results on a higher position in a similar situation. The more data the platform acquires, the better it performs.

- **Indirect network effect.** If the number of users in a different group (or different groups) matters to a user of a digital platform, there are indirect network effects. An online marketplace is especially interesting for a consumer if there are many sellers, because he or she might then benefit from lower prices and a better choice. Conversely, a seller benefits from a large number of potential buyers. We summarize such effects as positive indirect

network effects. If the effect on a user of there being more users in the other group(s) is negative, this is a negative indirect network effect. An example of this is an ad-financed digital platform: The more space on the platform's website is used to show ads and the more advertisers there are, the less attractive the platform becomes for a user.

The distinction between direct and indirect network effects is not always straightforward. Disregarding the advertisers on the video platform YouTube, its users could be defined as one group only. This seems appropriate since most of the videos are private ones uploaded by private consumers. There is only a positive direct network effect in this case. This does not capture the nature of the platform very well, however. There are users that are more likely to upload videos and those that mostly only watch them (Evans/Schmalensee, 2016). More people uploading videos attracts more people that watch videos and vice versa. Accordingly, there are indirect network effects between different groups of users.

Indirect network effects are not always determined or defined in the same way. For example, Hagiu/Wright (2015) use the term 'indirect network effect' only if there is an effect in more than one direction. That means that on a two-sided platform, both sides must be affected, either positively or negatively, by an increase in the number of users in the other group. If the effect only goes in one direction, the authors do not define it as an indirect network effect.

Moreover, in his overview, Shy (2011) notes that some authors refer to a single indirect network effect in cases where group A benefits if there is a large number of users in group B, who are then attracted by a large number of users in group A. We interpret this as two positive indirect network effects. On the one hand, the users in group B attract a large number of users in group A. On the other hand, users in group A attract a large number of users in group B.

## 2.3 Critical mass frontier

Indirect network effects are somewhat of a chicken and egg problem (Caillaud/Jullien, 2003). It is hard to determine which comes first: The large number of real or expected users in group A, who then attract users in group B; or the

large number of real or expected users in group B, who attract users in group A. In either case, a large number of consumers in one group attracts a larger number of users in the other, who attract more users in the first group and so on. The separation of the two indirect network effects allows us to show that there are indeed two effects reinforcing each other rather than just one. This reinforcement can lead to what is known as market tipping: A firm's market dominance increases due to the presence of indirect network effects (Dubé et al., 2010). This so-called positive feedback is a unique feature of network industries, which "make the strong grow stronger […] and the weak grow weaker" (Shapiro/Varian, 1999, 174). However, this can also work the other way round: A small number of users in one group fails to attract users in the other group, which further decreases the attractiveness of the platform for the first group and so on. This is referred to as negative feedback (Shapiro/Varian, 1999, 176).

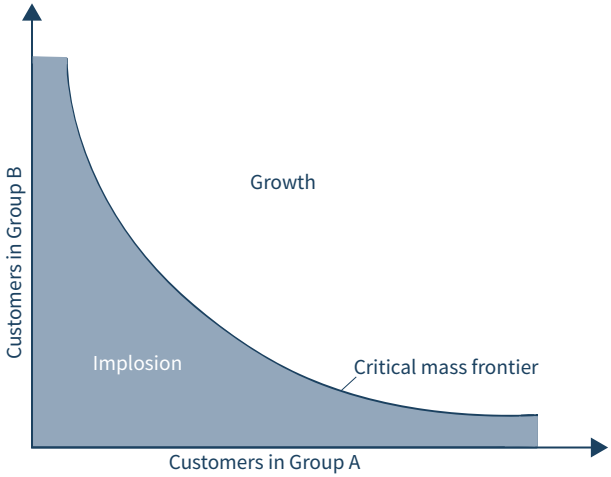
Against this backdrop, Evans/Schmalensee (2016) introduce the so-called critical mass frontier (Figure 2). Suppose that there are once again two different groups on a digital platform, group A and group B. There are mutually positive indirect network effects between these groups, i.e. the more people of one group join the platform, the more attractive the platform is for the users in the other group. This also implies, however, that only a small number of users in group A will not attract many users in group B and vice versa. This situation is depicted in the blue area of Figure 2, where the scarcity of users in one group causes the users in the other group to leave the platform and vice versa. In the end, this vicious circle leads to implosion and the shutdown of the platform.

In contrast to the situation in the lower left, once the number of users in groups A and B is sufficiently high to attract users of the other group, a self-feeding process starts. It leads to growth in the popularity of the product or service and therefore the number of users in both groups. Eventually, this makes the digital platform successful. The so-called "critical mass frontier" depicts all combinations of users of the two groups that are sufficient to start the self-feeding process.

To be successful, therefore, it is essential for any platform enterprise to reach the critical mass of users. Where the critical mass frontier actually lies depends

**Critical mass frontier** Figure 2

Development of digital platforms with positive indirect network effects




Source: Evans/Schmalensee, 2016, 78

on the characteristics of the multi-sided market at hand. While a critical mass of users usually implies greater numbers, it is also possible that the critical mass is small, at least on one side of the platform. Evans/Schmalensee (2016, 29 f.) emphasize that for a platform to be successful, "it has to make sure there are enough participants on each side […]" and that a concentration on one market side is not necessarily positive. Nevertheless, as Figure 2 shows, the higher the number of users in one group, the smaller is the number of users needed in the other group. For example, by offering a service that is free or priced below marginal or average costs, a platform may get close to, or even beyond, the critical mass frontier. Sony used the latter strategy when it introduced the PlayStation 4 gaming console, which was available at prices below cost (ComputerBase, 2013). By attracting a broad user base at the start, the PlayStation became attractive for video game developers and its Blu-Ray standard became attractive for film companies. More films and games then attracted more consumers. For digital platforms, offering a free service on at least one side is a common procedure (cf. also Chapter 4.2).

When policy-makers discuss digital platforms, their focus oftentimes is on those businesses that have crossed the critical mass frontier and parts of which

have grown to an enormous size. However, there are other platforms that strive to achieve critical mass but, for the time being, remain small. An example of this in Germany are platforms for sharing consumer goods.

## 2.4 Determinants of market power

Indirect network effects are a typical characteristic of digital platforms and are crucial for their success. Internalizing these external effects improves the efficiency of the economy. The stronger the network effects are and the more positive effects there are between the different platform-groups, the better are a digital platform's prospects. This includes the potential for market concentration or even market tipping. However, network effects are not the only determinant of concentration in a market that a digital platform is active in. Evans/Schmalensee (2007) identify four additional determinants of industry structure:

- **Scale Economies.** Developing, establishing and maintaining a platform is associated with high (fixed) costs. The variable costs of adding an additional user to the platform are close to zero, however. This results in decreasing average costs and therefore in economies of scale. For instance, once an online search engine has established its website and programmed an appropriate algorithm, the total costs for 100 or 1,000 search queries do not differ much. In general, digital platforms exhibit economies of scale. Diseconomies of scale are also possible, however. This could happen if adding a new feature to the digital platform or targeting an additional group of consumers increased complexity disproportionately or was simply too expensive.

  Note that market concentration due to economies of scale and due to market-tipping are conceptually different. The latter implies that concentration is caused by a positive feedback effect as the platform is particularly attractive to users (winner-takes-all market). The former means being able to offer a product or service at low prices because of high output, which might also cause market power or even lead to a natural monopoly. Nevertheless, scale economies make it possible to react to a high number of requests from all platform sides. Therefore, the two effects can reinforce each other.

- **Congestion.** Congestion may arise if the number of users negatively affects the efficiency of the platform's matching process. This is particularly a problem for physical platforms, but it can also occur in online markets. For instance, if there is a shortage of server capacity, an online auction website may not be able to consider all bids for a given auction, especially if most of them come in close to the end of the auction.

- **Platform differentiation.** Platforms differentiate themselves in order to target different groups of users (horizontal differentiation) or they choose particular levels of quality (vertical differentiation). Platform differentiation may be a response to congestion or a way to prevent it. An example of platform differentiation are online dating platforms. Horizontal differentiation refers to differences in the intent of the matches. There are digital platforms aimed at more casual dating and those that focus on long-lasting relationships. In this market, platforms also differentiate vertically by offering extended services (of higher quality) for paying members. Non-paying members receive a lower quality of service.

- **Multi-homing.** Consumers may use several similar platforms for different or even the same needs (Demary, 2015, 5). It is important to note that the decision to use one or several digital platforms for a service is an individual one that each user makes (Sun/Tse, 2007, 18). The aggregated behavior of all users therefore determines the outcome at the market level. Multi-homing can be a result of platform differentiation because consumers are interested in different features on differentiated platforms (Evans/Schmalensee, 2007).

  Crucial for multi-homing are switching costs and the costs of becoming a user of a platform. Switching costs depend on the type of platform. If they are prohibitively high, the platform locks the user in (Shapiro/Varian, 1999, 103 ff.). From a digital platform's perspective, this is highly desirable. The higher the costs for switching, the more stable is a platform's market position and therefore its market power.

Besides these five determinants of market power, innovation also is of great importance. Grave/Nyberg (2017, 364) use the term "leapfrog competition":

Digital platforms may have a large or dominant market share. If they abuse it or do not innovate, a new entrant with an even better product or service could drive them out of the market. Consequently, even monopolist digital platforms cannot be sure of their market position and rely on monopoly profits but constantly have to adapt their business model in order to remain attractive to users. The development of social networks is an example of this (Körber, 2015, 124). Although MySpace and VZ-Networks were the dominant market players in the United States and Germany respectively, they are not important today because Facebook offered a product more in line with demand. Innovation often needs to be disruptive for digital platforms (Grave/Nyberg, 2017, 364). Small improvements or products and services similar to what is already in a market are not very likely to be successful. This was exemplified by the social network Google+, which was unable to compete with Facebook because it was not innovative enough.

The factors outlined above influence market concentration in different ways. Strong and mutual indirect network effects clearly have the potential to increase market concentration. Scale economies lead to bigger and dominant digital platforms as well. On the other hand, multi-homing users, a pronounced platform differentiation, congestion, diseconomies of scale and strong market dynamics tend to result in less concentrated markets and set limits to the size and market power of platforms.

## 2.5 Classification of digital platforms

Many studies have categorized digital platforms or digital business models (e.g. Lichtblau et al., 2018; Arnold et al., 2016; Engelhardt et al., 2017; Schmidt, 2016). While their classification depends very much on the definition of the business model itself, the specific focus of the study also has a great influence. For instance, digital platforms may be grouped by the type of transaction they facilitate, i.e. search, networking or sharing goods (Arnold et al., 2016).

Since the definition of digital platforms in this study is rather narrow, we derive a specific classification from it, focusing on the type of network effects that come with a specific business model. Network effects have great relevance for the digital platform business model in general. However, since the structure

## Categories of digital platforms

Table 1

By network effects

| | | Direct network effects | | | |
|---|---|---|---|---|---|
| | | Only positive | Positive & negative | Only negative | No effect |
| Indirect network effects | Only positive | Complementarities within groups | | Rivalries within groups | |
| | Positive & negative | Ad-financed digital platforms | | | |

Own depiction

of network effects differs from platform to platform, it makes sense to use them for the categorization of digital platforms (Table 1).

Direct and indirect network effects can both be present on digital platforms. With respect to the direct effects, the following scenarios can occur:

- **Only positive direct network effects.** There are only positive direct network effects if users in at least one group benefit from an increase in more users in the same group (i.e. there are complementarities) and users in no group have a disadvantage if their group size increases.

- **Only negative direct network effects.** There are only negative direct network effects if users in at least one group have a direct disadvantage from there being more users in the same group (i.e. there are rivalries) and users in no group benefit if their group size increases.

- **Positive and negative direct network effects.** Positive and negative direct network effects occur if users in at least one group have a direct disadvantage from there being more users in the same group and users in at least one (other) group benefit if their group size increases.

- **No direct network effects.** No direct effects occur if changes in the size of any group have no effect on the users in that group. Note that this can only happen in cases where there are neither rivalries nor complementarities within the different groups.

With respect to indirect effects, there are two possible scenarios:

- **Only positive indirect network effects.** There are only positive indirect network effects if users in at least one group benefit from there being more users in another group and no group of users has a disadvantage from there being more users in any other group.

- **Positive and negative indirect network effects.** If users in at least one group benefit from there being more users in another group and users of at least one group have a disadvantage from there being more users in another group, there are positive as well as negative indirect network effects.

Note that there are no categories for only negative indirect network effects or no indirect network effects. This is due to our definition of a digital platform (cf. Chapter 2.1), which is that it facilitates interactions between two or more independent groups of users. There thus has to be at least one positive indirect network effect. This means that on at least one side of the platform, the users must have a wish to be matched with users on another side. If not, they would have no incentive to use the platform, especially if all groups faced a disadvantage due to negative indirect network effects. Therefore, the essence of digital platforms lies in the existence of at least one positive indirect network effect. In line with the observation that there is no commonly accepted definition of digital platforms, this is a property of digital platforms that is sometimes disputed (e.g. Hagiu/Wright, 2015, 6 f.).

Positive and negative indirect network effects on the same platform are widespread and mainly occur if digital platforms at least partially finance themselves via advertisements. Advertisers benefit from a large number of users on another side of the platform seeing their advertisements. By collecting and analyzing data, the platform itself might even be able to provide a close fit between a single user and an advertisement. Accordingly, there is at least one positive indirect network effect. However, users are likely to have a disutility, i.e. a negative indirect network effect, if there are too many advertisements. Following this approach, any digital platform that accepts advertisements to finance itself or to increase profits belongs in the "Positive and negative indirect network effects" row in Table 1.

While many digital platforms use advertisements as a means of finance, it is important to note that not all ad-financed websites are digital platforms. The central idea of a platform is to facilitate matches between at least two different sides. This particularly excludes so-called attention-seeking platforms (Bundeskartellamt, 2016, 24) that would otherwise be found in the two bottom right cells of Table 1. Take an ad-financed news website with readers and advertisers, for instance. While the advertisers experience positive indirect network effects, the readers of the content are not interested in the other side (negative indirect network effect), but only in the news. The website therefore matches the advertisers with the readers but does not match the readers with any group. It merely provides the content the reader is interested in. In other words, there are no positive indirect network effects on the side of the readers. That is why such an attention-seeking business model does not constitute a digital platform.

The situation is different for a general search engine with three sides: searchers, websites that want to be found, and advertisers. While the advertisers have the same positive indirect network effect as those on the news website, such effects are now present for the other two groups as well. The searchers benefit from the large number of websites that can be found via the platform because this makes it more likely that their search will lead to suitable results. The websites benefit from the many searchers that can find them via the platform. Hence, there are positive indirect network effects for all groups.

Another challenge when identifying digital platforms is categorizing businesses that have more than one division or business model, and where the digital platform is thus only one part of a bigger company. A good example of such an enterprise is Apple Inc. Its app store and iTunes are digital platforms but only represent around 20 percent of Apple's net sales (Apple, 2017, 23). Since Apple earns most of its money by selling hardware, especially iPhones, it might not be appropriate to define it as a digital platform.

Due to such cases, we restrict our analysis to enterprises with a business model that is dominated by one or more digital platforms. For example, we categorize Amazon.com Inc. as a digital platform, although in 2016 it had net retail sales on its own behalf (and thus not as a digital platform) of US$91.4 billion

and only US$23 billion in retail third-party seller services (as a digital platform) (Amazon, 2017, 68). The reason for this is that Amazon's unique selling point is the Amazon website, where anybody can sell goods and where nearly everything can be bought.

To sum up, the assignment of some large companies to the digital platform business model is always somewhat arbitrary. This also holds for the division of single digital platforms into the categories defined above. Table 2 proposes a number of examples based on popular digital platforms. To some extent, the categorization also depends on the specific situation a platform finds itself in, especially with regard to direct effects. If there is high demand on one platform side, rivalries occur, while they are not present where there is a high level of supply.

As mentioned above, platforms which accept advertisements always exhibit negative indirect network effects caused by the advertisers. These business models therefore belong in the bottom row of Table 2. The specific categorization again depends on whether there are rivalries within the user groups of a platform or not. Take YouTube, for example, with its three user groups of advertisers, content providers and viewers. There are positive direct network effects for the viewers since each additional viewer improves the search algorithm of the platform and therefore the quality of the search results for video

**Popular digital platforms** Table 2

Categorization by network effects

| | | Direct network effects | | | |
|---|---|---|---|---|---|
| | | Only positive | Positive & negative | Only negative | No effect |
| Indirect network effects | Only positive | Wikipedia | Yelp (Europe) | Uber<br>Airbnb<br>Tinder | PayPal |
| | Positive & negative | | Google<br>Facebook<br>YouTube<br>Yelp (US, Canada) | LoveScout<br>Amazon | |

Own depiction

content. However, content providers (and advertisers) experience negative direct network effects. The more content is provided, the less likely it becomes that the content uploaded by a single provider will be found and watched. Some platforms, such as dating websites, exhibit even more rivalry between users within each group. In this case, there are no positive direct network effects. Every additional member of one user group reduces the likelihood that another member of this group will find a match.

Note that in Table 2 there are no examples of platforms with both positive and negative indirect network effects and either only positive direct effects or no direct effects. This does not mean that such cases do not exist, but that there are no general examples that always hold. No direct network effect implies that the users on all sides are indifferent to the number of users on their side. This could be the case for an ad-financed platform where there are no rivalries between advertisers since there are ample advertising opportunities. While this is not impossible, it seems more likely that advertisers do experience negative direct network effects due to prices rising when demand increases. On the other hand, where direct network effects are all positive but there are some negative indirect effects, this implies that advertisers may even benefit from other advertisers. This seems even less likely, but could be the case in a themed advertising campaign on a digital platform where the products or services of the different advertisers complement each other.

Digital platforms that do not carry advertisements usually exhibit only positive indirect effects. For the categorization, though, it still matters whether there is competition or not. Take the example of Uber. Uber manifests positive indirect network effects and usually only negative direct ones. For riders as well as for drivers, the presence of other users in the same group heightens competition. In the case of the riders, the result is higher prices, whereas in the case of the drivers, they are lowered. Platforms like PayPal do not experience such congestion effects. There are virtually no direct network effects. An additional consumer using PayPal has no effect on other consumers, just as firms using PayPal to collect payments are unaffected by other companies using the same service.

Online reviewing platforms like Yelp exhibit both positive and negative direct network effects. The negative effect is due to competition for customers be-

tween the restaurants reviewed. The positive effect stems from the greater aggregate validity of reviews when the number of reviewers increases. In Europe, the indirect network effects are all positive in the case of Yelp. In the US and Canada, the platform carries advertising (Yelp, 2018), creating additional negative indirect effects and thus putting the platform in the bottom row of Table 2.

The online encyclopedia Wikipedia is an example of a digital platform with only positive (direct and indirect) network effects. Both readers and writers benefit from an increase in the size of the other group. Readers enjoy a greater variety and possibly better quality of content if there are more writers. For the writers, a higher readership provides a greater incentive to contribute. These are the indirect network effects. Also, a greater number of readers is better able to spot mistakes in the entries, so that quality increases. Similarly, the more writers there are, the more likely it is that a text will be proofread, which again increases quality.

Overall, Tables 1 and 2 reflect the variety of digital platform business models. Monetarization of the service offered by a platform is the key to determining a company's position in each table, a feature we will analyze further in Chapter 4.2. The nature of the product or service that the platform helps to deliver is less relevant for the classification than the interaction between the different user groups because the latter determines the platform's strategy with respect to pricing and the use of data.

# 3 The importance of digital platforms

Although the most prominent digital platforms regularly feature in both the media and research papers, empirical evidence on this group of companies is scarce. This chapter will nevertheless attempt to shed light on the phenomenon of digital platforms as a business model, to demonstrate their significance and to analyze their development. Besides secondary data from a variety of sources, we use a unique dataset for the companies with the highest market capitalization worldwide that are not publicly traded. Generally, the definition of

digital platforms varies between the different data sources and often does not correspond to the general economic definition put forward in Chapter 2. We take account of this when interpreting the data and therefore arrive at rather tentative conclusions.

## 3.1 Digital platforms among unicorn companies

There are some studies that aim to capture all digital platforms worldwide above a certain threshold (e.g. Evans/Gawer, 2016). However, the sheer number of companies pursuing this business model makes finding, listing and collecting data on them a rather daunting task. For our analysis, we therefore focus on a specific group of companies, namely the so-called 'unicorns'. This term applies to unlisted companies with a market capitalization of at least US$1 billion. We use the comprehensive list of unicorn companies as of September 2017 compiled by Crunchbase (2017). We then categorize each of these companies according to the definition of a digital platform put forward in Chapter 2.1.

Of the 268 companies in the sample, we classify 110 as digital platforms (Table 3). This type of company therefore accounts for roughly 40 percent of all unicorns. The significance of this proportion is difficult to assess since there are no data on digital platforms in the world economy as a whole. The impact of the internet as a facilitator of digital platforms only became evident in the 1990s (Internet Society, 1997). It therefore seems likely that the share of digital platforms among all companies worldwide is much lower than their share among the unicorn companies.

**Digital platforms among unicorn companies** Table 3

Companies with a market capitalization of at least US$1 billion that are not publicly traded, as of September 2017

| | Number of companies | Share of all companies, in percent | Share of total market capitalization, in percent |
|---|---|---|---|
| Digital platforms | 110 | 41.0 | 56.5 |
| Other business models | 158 | 59.0 | 43.5 |
| **Total** | **268** | **100.0** | **100.0** |

Own calculations based on Crunchbase, 2017

This could point to a more general development by which the digital platform spreads out and replaces other business models in the so-called platformization of economies. Alternatively, the high occurrence of digital platforms among the unicorn companies could simply imply that they have a high likelihood of crossing the US$1 billion market capitalization threshold. It cannot be determined at this point which, if either, of these explanations holds.

Interestingly, the available data seem to indicate that, on average, digital platforms have a higher market capitalization than the other companies in the sample. While the latter represent 43.5 percent of the total market capitalization of the unicorn companies, digital platforms account for 56.5 percent (Table 3). This result is strongly driven by the variance in market capitalization in the sample and the overwhelming dominance of the digital platforms with the highest market capitalization. Of the top 10 unicorn companies, six are digital platforms. Taken together, their market capitalization is more than 2.3 times that of the four other companies in the top 10 (US$253.5 billion compared to US$106.3 billion). Overall, the combined market capitalization of the 268 unicorn companies amounts to US$530.8 billion.

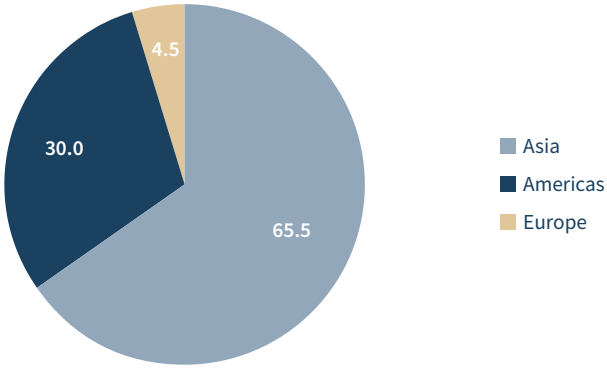
The unicorn companies are located in 21 countries across the world. Digital platforms are present in 14 of these. The highest number of digital platforms are to be found in Asia (Figure 3): Nearly two thirds of such companies have their headquarters on this continent. A further 30 percent are in the Americas, while Europe accounts for just 5 percent. This result is in line with Evans/Gawer (2016), who also find – for their definition of digital platforms and for a different, albeit partly overlapping, sample of companies – that Asia is the continent with the most digital platforms (in their data 46 percent), followed by North America and Europe. Besides the often cited poor availability of venture capital in Europe (e.g. Röhl, 2016, 20 ff.), another possible reason for Europe's small share is that many, especially North American, digital platforms also cater to the European market. By contrast, Asian markets, in particular the huge Chinese market, are mostly served by Asian platforms.

Of all digital platforms, those in the Americas have the highest average market capitalization. Their average value is US$5.7 billion, followed by Asian platforms with US$4.6 billion, while European digital platforms have an average market

## Regional distribution of digital platforms

Figure 3

**Percentage of all digital platform companies with a market capitalization of at least US$1 billion that are not publicly traded, as of September 2017**




Data: http://link.iwkoeln.de/398186
Own calculations based on Crunchbase, 2017

capitalization of just US$1.9 billion. These results are driven by the performance of digital platforms in relatively few individual countries (Table 4). While, at 53, the number of digital platforms is highest in China, the average market capitalization per platform is highest in the United States, at US$5.8 billion per company. China comes a close second with US$5.1 billion on average. Of the 14 countries in the sample where digital platforms are located, half host only a single platform. Three further countries host two digital platforms each.

The geographical distribution of digital platforms is influenced by several factors. In general, the following characteristics influence how large a digital platform can grow in a specific market:

- **Availability of venture capital.** Innovative start-ups need financing that caters to the risks involved in founding such a business. In consequence, they are largely dependent on venture capital, the availability of which varies from region to region (e.g. Knoema, 2017).

- **Regulatory framework.** The ease of starting a business as well as such other factors as property rights, government efficiency and infrastructure

## Digital platforms by country

Table 4

Selected figures of platform unicorns, as of September 2017

| Country | Number of digital platforms | Share of digital platforms, in percent[1)] | Total market capitalization, in US$ billion | Average company market capitalization, in US$ billion |
|---|---|---|---|---|
| China | 53 | 48.2 | 270.0 | 5.1 |
| USA | 32 | 29.1 | 185.3 | 5.8 |
| India | 9 | 8.2 | 38.4 | 4.3 |
| Indonesia | 3 | 2.7 | 5.0 | 1.7 |
| UK | 2 | 1.8 | 3.0 | 1.5 |
| ROK | 2 | 1.8 | 9.0 | 4.5 |
| Singapore | 2 | 1.8 | 9.2 | 4.6 |
| UAE | 1 | 0.9 | 1.2 | 1.2 |
| Brazil | 1 | 0.9 | 1.4 | 1.4 |
| France | 1 | 0.9 | 1.6 | 1.6 |
| Japan | 1 | 0.9 | 1.0 | 1.0 |
| Netherlands | 1 | 0.9 | 2.3 | 2.3 |
| Sweden | 1 | 0.9 | 2.5 | 2.5 |
| Taiwan | 1 | 0.9 | 1.0 | 1.0 |
| **Total** | **110** | **100.0** | **530.8** | **4.8** |

Unicorn companies: market capitalization of at least US$1 billion, not publicly traded.
1) Percentage of all digital platforms in the sample.
ROK: Republic of Korea; UAE: United Arab Emirates.
Own calculations based on Crunchbase, 2017

also differ across regions (e.g. Knoema, 2017). This can influence the decision to found a digital platform in a particular country or region.

- **Size of the market.** The larger a market is, the more potential customers there are and the greater the likelihood that a digital platform will cross the critical mass frontier (cf. Chapter 2.3).

- **Maturity of the market.** Oftentimes, several platforms with very similar business models compete in one market (Demary, 2016, 13 ff.). Over time, the intense competition usually results in market concentration, a decrease in the number of platforms and an increase in their size.

- **Economies of scale and scope.** It is easier for a newly-founded digital platform to thrive if the eco-system surrounding it is supportive. This refers to the economies of scope associated with a clustering of human capital or

suitable infrastructure, for example, as well as to the economies of scale that can be realized by cooperation.

- **Nature of the business model.** Generally, the nature of the business model influences the potential size of the platform. This includes the nature of the service offered as well as its utility for its users. Business policy with respect to growth objectives and way of doing business can also be relevant.

- **Other factors.** The location of innovative start-up companies follows a certain path-dependency (Röhl, 2016, 5 ff.). Regions like Silicon Valley in the United States have a long tradition of start-ups, a large number of role models for potential founders and an eco-system that fosters entrepreneurship.

With respect to the sample of digital platforms analyzed here, the quality of the data does not allow sound conclusions to be drawn as to the reasons for their geographical distribution. However, it is hardly surprising that the largest platforms are located in some of the largest markets.

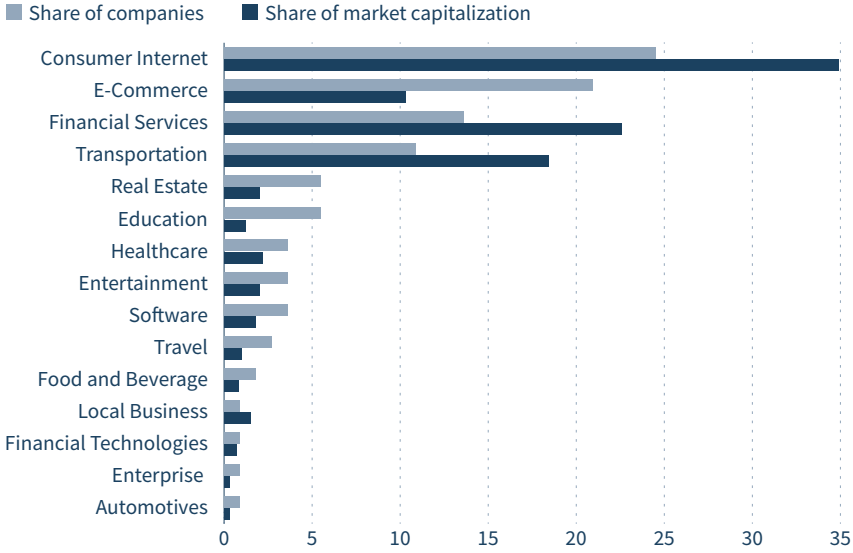
The unicorn companies in the sample are categorized according to the main sector they are active in. The categorization does not always follow a pattern, however. The ride-hailing companies Uber (United States), Grab (Singapore) and Ola (India), for example, are categorized as transportation while their Chinese counterpart Didi Chuxing is to be found under consumer internet. Similarly, some digital platforms are categorized as financial technologies, others as financial services. The distinction is not always clear-cut and the method of categorization remains unclear. This needs to be considered in the interpretation of the results.

Of the 110 digital platforms in the sample, most are active in the consumer internet sector (Figure 4). Nearly a quarter of all digital platforms are in this sector, which consists of different types of business models that focus on consumer demand. Apart from the aforementioned ride-hailing company, food delivery, handyman services and photosharing platforms belong in this sector. About 20 percent of all digital platforms are categorized as e-commerce, making this sector the second most common. Financial services and transportation come third and fourth respectively.

## Digital platforms by sector

Figure 4

**Share of companies with a market capitalization of at least US$1 billion that are not publicly traded and those companies' share of market capitalization, in percent, as of September 2017**




Data: http://link.iwkoeln.de/398187
Own calculations based on Crunchbase, 2017

The sectors' shares of the total number of digital platforms do not necessarily correspond to their shares of market capitalization. The consumer internet sector accounts for nearly 35 percent of market capitalization, 10 percentage points more than its share of digital platforms. In contrast, the e-commerce sector represents roughly 10 percent of total market capitalization, 10 percentage points below its share of all digital platforms. Thus consumer internet platforms enjoy an average market capitalization of US$6.9 billion, while e-commerce platforms are valued at US$2.4 billion on average.

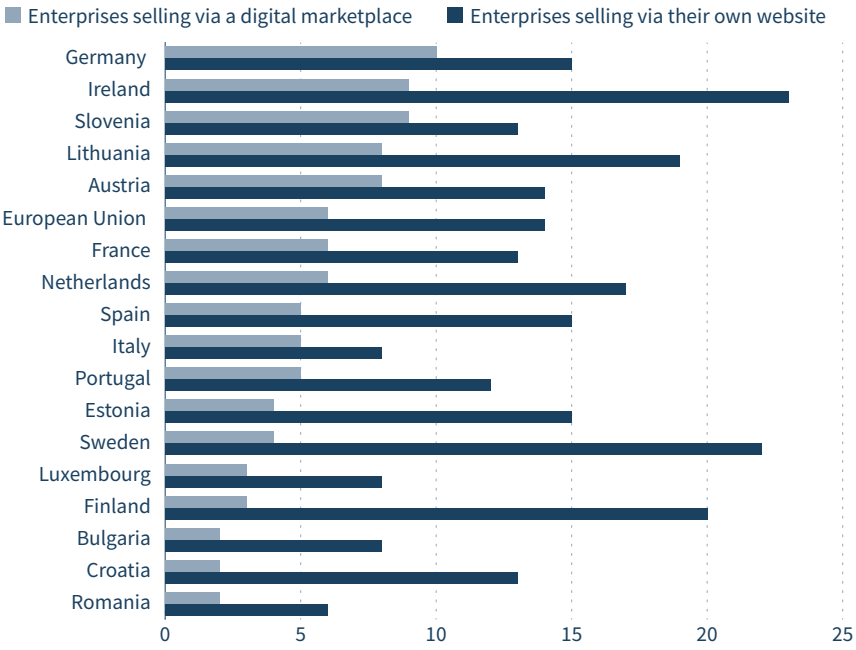
Two other sectors that have a disproportionately higher share of market capitalization are financial services and transportation, which make up about 23 and 18 percent of market capitalization respectively. These sectors also account for the highest average market capitalization per platform. Transportation platforms are valued at US$8.2 billion per platform, financial services at an even US$8 billion.

## 3.2 The importance of digital marketplaces

In its 2017 survey on the use of information and communication technology (ICT) in enterprises, the European Union included e-commerce sales and turnover, which allows an assessment of the significance of digital platforms in the form of marketplaces in Europe (Figure 5). For most companies, offering their goods and services via such a platform is not yet important. For all EU countries, the share of companies that use this route, among others, for sales is 10 percent or less. Germany has the highest share with 10 percent, Romania the lowest with 2 percent. On average, 6 percent of EU enterprises use digital marketplaces as a sales channel. This seems to contradict the notion that Europe's economies are undergoing platformization. Even in companies that are at the forefront of these developments – i.e. where at least 20 percent of web sales stem from digital marketplaces – this sales channel seems to be relatively little used.

**The importance of sales via a digital marketplace in selected EU countries** Figure 5

Share of enterprises in 2017, in percent




Data: http://link.iwkoeln.de/398188
Source: Eurostat, 2017

On average in the EU, only 5 percent of these companies' turnover results from web sales. If all companies with web sales are included, the share is higher, namely 7 percent (Eurostat, 2017). In Germany, sales via digital marketplaces account for 18 percent of the turnover from web sales (Statistisches Bundesamt, 2017), with 82 percent generated by sales via companies' own websites or apps.

Digital marketplaces therefore still play a much less significant role for most enterprises in the EU than it might seem. This may partly be because the digital single market is still incomplete and businesses cannot yet fully realize economies of scope. This result does not imply, however, that the importance of digital marketplaces will not increase in the future. This could very well happen in the next few years. For now, however, with certain exceptions, the reliance of most European businesses on digital marketplaces is very small. Some economists would even go so far as to say that digital platforms have hardly disrupted traditional businesses (Evans/Schmalensee, 2016) and only affected "analogue" matchmaking businesses, such as shopping malls in the case of digital marketplaces like Amazon. While this analysis may be somewhat narrow, the data for the EU demonstrate that fear of platformization currently seems to be unwarranted.

# 4 The market behavior of digital platforms

Their unique characteristics allow digital platforms specific behavior in markets. Their rapid growth often enables them to become a significant market player soon after market entry, while their use and combination of data from the different sides of their platform help them to create unique business models. The aim of this chapter is to shed light on the market behavior of digital platforms and determine the degree to which they affect other market participants. It will therefore analyze in more detail digital platforms' market influence, their pricing strategies, their use of data and their transparency.

## 4.1 How digital platforms change markets

Like any other company, digital platforms influence markets. Depending on their exact business model and product or service, this influence may be restricted to one market they are active in or span several, often diverse, markets. The effects of digital platforms on markets are hence often quite different, or more pronounced, than those of traditional firms. This is largely due to digital platforms' unique characteristics (cf. Chapter 2). Against this backdrop, the following analyzes the ways in which digital platforms change markets and how influential they can become.

### 4.1.1 Market structure

One major characteristic of digital platforms is that they are multi-sided. These several sides also suggest that the definition of the relevant market for a digital platform is not always straightforward (OECD, 2017, 137 f.). The number of markets that a platform serves depends on its business model. Some platforms are active in one market only (Bundeskartellamt, 2016, 6 f.), such as Couchsurfing or Airbnb in the market for private accommodation. Others serve several markets. Google Search is part of the market for general online searches on the sides of the searchers and the websites they search for, for instance, but it is also part of the advertising market on the side of its advertising customers. Along with the general dynamics of the digital economy, the platform's potential presence in more than one market poses a challenge for competition authorities (Körber, 2015, 124 ff.). In order to be able to apply antitrust regulation to digital platforms, competition authorities need to define the relevant market. Political discussions about the market power of digital platforms (e.g. BMWi, 2017, 41 ff.) often neglect this particularity. Yet it is necessary to focus on the different markets that a digital platform caters to and proceed from there. This requires identifying a platform's competitors. If not all of them are included in the market definition, the platform's market position is likely to be overestimated.

The properties of digital platforms, such as network effects, positive feedback and economies of scale, can lead to rapid growth in the shape of a virtuous circle (Shapiro/Varian, 1999, 176). That is why digital platforms are often able to rapidly gain a significant market position, at least in the market on one side of the platform. Initially, the market entry of a digital platform increases the

number of competitors in that market and thus also competition (Demary, 2016, 13 f.). In that sense, the market entry of a digital platform has the same effect as that of any other firm. Their potentially extremely high growth rate distinguishes digital platforms from traditional companies, however. While it usually takes years for the latter to grow their market share, digital platforms are theoretically able to change the shape of a market within months. Why this is the case can be demonstrated by comparing Airbnb to a traditional hotel. To increase capacity or to expand into a new market, a hotel needs money and time, because new rooms or a new hotel have to be built. However, since Airbnb does not own the rooms it rents out, it can expand quickly simply by attracting new hosts. The initial success of Airbnb or any other digital platform depends largely on crossing the critical mass frontier (cf. Chapter 2.3). Once they have accomplished that, they are often able to gain large market shares quickly. Markets in which digital platforms are active are often characterized by very few large players, or even a monopoly.

This is typical not only for digital platforms but also for the information economy as a whole (Shapiro/Varian, 1999, 173 ff.). This latter term loosely covers all business models that deal with information goods, usually via the internet. Networks, rather than value chains, are the predominant organizational form in the information economy, which is indeed often labeled the "network economy" as well. Digital platforms are certainly a part of the information or network economy, although both of these terms include many other business models as well. There is a consensus that monopolistic tendencies are an integral part of many digital business models. For instance, in 2015, nearly 50 percent of the European Union's internet traffic was channeled through 1 percent of the websites that are actively trading in all member states (EU Commission, 2015a, 52). Similarly, when the OECD (2017, 120 f.) analyzed data on business entry rates in ICT markets in eight countries between 1998 and 2013, they found that the ICT-producing sectors in most countries exhibited a declining dynamism. This was most obvious in non-financial business services. A majority of countries also experienced falling entry rates in those sectors which use ICT.

While there are several explanations for these results, the characteristics of digital business models in general, and digital platforms in particular, make likely culprits. The strong network effects of digital platforms give rise to so-

called winner-takes-all markets, in which the strongest firm acquires such a large market share that it dwarfs even that of the second-largest firm (OECD, 2017, 121). This is often referred to as the 'tipping' of a market (Evans/Schmalensee, 2007, 164).

Andrews et al. (2016) demonstrate these dynamics empirically using firm-level cross-country productivity data. Comparing frontier firms, i.e. those that are ahead of other enterprises in many respects, and laggards, they find that ICT-intensive services in particular have a more pronounced divergence of multi-factor productivity between the two groups. Frontier firms in general increased their market share between 1997 and 2014. Relative to all frontier firms (top 5 percent), the elite (top 2 percent) have gained in market share.

The empirical evidence therefore points to winner-takes-all dynamics (as well as to economies of scale) in these markets. In economic theory, this result is often seen as the consequence of perfect foresight on the part of the users (e.g. Katz/Shapiro, 1985; Shy, 2011). The market develops according to their expectations – the dominance of one digital platform versus the coexistence of several – thus fulfilling them. By contrast, a dynamic approach uses past observations of users instead of expected platform size (Sun/Tse, 2007). In this case, winner-takes-all dynamics are particularly likely if users in the relevant market use one platform only instead of multi-homing (cf. Chapter 2.4). Sun/Tse (2007) find that several digital platforms are able to coexist if users are active on more than one of them. As the tendency to multi-home increases, so does the long-term likelihood of several digital platforms coexisting in the same market.

The economic literature often does not clearly distinguish between the concepts of winner-takes-all markets and natural monopolies (cf. also Chapter 2.4). The resulting market structure is similar; what might differ is the reason for the emergence of a monopolistic market. Winner-takes-all dynamics are driven by strong network effects and positive feedback and are therefore common among digital platforms. They are also strongly driven by a platform's ability to attract and retain users and are therefore significantly influenced by demand. Independent of the nature of the business model and the number of companies in a market, natural monopolies generally occur when one company is able to satisfy demand at lower cost than several companies could (Posner, 1969, 548).

Typical natural monopolies include markets with a network infrastructure, such as telecommunications and electricity markets. But economies of scale that imply huge fixed but negligible variable costs are also a characteristic of digital platforms. Particularly the fixed costs that such platforms incur for development, set-up and maintenance point towards a natural monopoly. The cost structure of digital platforms does indeed facilitate their ability to use network effects to their advantage. However, the presence of a natural monopoly always depends on the exact business model, the level of fixed costs and the market. Thus while it is true that for some business models there is a likelihood of a natural monopoly developing, any general conclusion that every platform market is potentially a natural monopoly is false. At the same time, platform markets are very dynamic. Market structures change quickly because nothing is constant: neither the number of competitors, nor the product or service, nor the processes, nor supply and demand. A natural monopoly implies some permanency, which platform business models may simply not be able to maintain. By contrast, the concept of winner-takes-all markets itself is dynamic and describes a process rather than an outcome. It is therefore a much better fit for the reality of digital platforms.

Once digital platforms have entered a market and crossed the critical mass frontier, the dynamics of their development are often straightforward. However, the market entry of digital platforms itself often differs from the market entry of traditional firms. While economies of scale imply high fixed costs (cf. Chapter 2.4), these costs may be lower than those of their competitors, particularly if the latter are traditional firms. Take, for instance, a sharing economy platform that matches homeowners wanting to rent out their apartment with prospective travelers seeking accommodation to rent. While it is certainly costly for the platform to set up and maintain a website or an app, the platform does not incur costs for the assets themselves, the apartments or other homes. In other words, this type of digital platform is asset-light and has a cost structure that can lower barriers to entry significantly (Demary, 2015, 12).

Unlike their competitors, such as hotels or vacation homes, these platforms do not have to invest in real capital before being able to grow their business model. Rather, the number of users facilitates growth. Both market entry and growth in the market are therefore much cheaper for such digital platforms,

which gives them a competitive advantage. Not all digital platforms are asset-light, however, and the relative ease of their market entry depends very much on their competitors and their costs and dynamics. The lower the difference between a platform's fixed costs and those of its competitors, the lower is its competitive advantage. In markets where several digital platforms compete, there is often no distinctive competitive advantage due to differences in fixed costs. Note that, besides cost advantages, digital platforms have other potentially relevant competitive advantages, such as differences in quality.

### 4.1.2 Competition and antitrust

Because digital platforms have such an influence on market structure, they strongly shape the nature of competition as well. Platform competition can mean either platform business models competing with one another or platform business models competing with traditional firms. In many markets, both happen simultaneously. Depending on the markets involved, one digital platform may actually be able to compete in several markets at the same time, often with different competitors. While the type and the effects of such competition will vary according to the business model and the markets, some more general observations are possible.

In general, digital platforms must adhere to the same rules of conduct that apply to traditional firms. However, the monopolistic tendencies of some digital platforms pose a challenge for their competitors. In this regard, competition in a market may even change to competition for a market (Wissenschaftlicher Beirat beim BMWi, 2017, 12), implying that once a digital platform has entered a market, the race for it is essentially over and it is just a matter of time before this platform turns into a monopoly. While this might be true for some markets, it is not for most. A monopoly position might be attainable, but only after a period of fierce competition with an uncertain outcome. And even if established, such a monopoly position would still be contestable due to innovation.

Many examples demonstrate that an oligopolistic market structure is also common for markets in which digital platforms are active. There are several digital platforms in the market for online travel bookings, for example, as well as in the market for ticket bookings and most markets for goods traded via

digital marketplaces. One reason for this lies in the possibility for users (often on all sides of the platforms) to multi-home, i.e. to use several competitors. At least as long as there remain discernible differences between them – e.g. with respect to their target groups or quality – there is room for several competitors in such a market. This also holds in cases where digital platforms compete with traditional businesses. Access to a digital platform's service requires internet access, internet competency and a general willingness to use the web. In the European Union in 2017, about 84 percent of individuals aged 16 to 74 had used the internet in the past three months (EU Commission, 2017a). This implies that there is a remainder of at least 16 percent who are unlikely to use digital platforms. Since only roughly 57 percent of respondees possessed even basic digital skills, this share is probably an underestimation. In markets where digital platforms and traditional business models compete, an oligopolistic structure is therefore likely. However, as digital literacy increases, digital platforms may continue to improve their market position.

Users' expectations can be vital for platform competition, in particular if digital platforms compete among themselves. In an oligopolistic setting with several digital platforms, users' expectations about the success of a specific digital platform influence market outcome (Katz/Shapiro, 1985). If users believe a platform to be successful, their willingness to pay for its service rises. This, in turn, can effectively lead to that platform's dominance. Crossing the critical mass frontier before their competitors should therefore be easier for those platforms that are able to convey the impression of dominance. This also holds where digital platforms compete with traditional business models, as Albedj/Gyllström (2015) demonstrate for the case of mobile payments versus card payments.

Digital platforms compete with other companies for market share and users. Although they are able to grow quickly, they can equally quickly be replaced by companies with a more innovative product or service. In view of this, innovation activity plays an important role for digital platforms that are keen to keep or even improve their market share. In many markets, digital platforms compete not only on price, but also on quality and the innovativeness of the platform delivering the service. Generally, it is crucial for platforms to attract a sufficiently high number of customers from different sides to be able to

compete successfully in the relevant market. Being the first platform to enter a market may be an advantage, but it does not ensure success (Evans/Schmalensee, 2016). If a new entrant platform provides a slightly better quality while indirect network effects are only moderate, the advantage of the incumbent diminishes (Zhu/Iansiti, 2007). Users will switch to the better quality offer. Due to the presence of positive indirect network effects, the entrant platform is able to grow its user base on both sides. Especially in cases of multi-homing, digital platforms with slightly better quality are able to overcome the disadvantage of being the new entrant (Sun/Tse, 2007, 35 f.). If both sides single-home, however, the incumbent has a position so strong that it is almost impossible to challenge, even with better quality.

Besides on price, innovation capacity and quality, digital platforms also compete with data. Their business model often allows them to collect, store, process and analyze the data their users and their activities on the platform provide. Via their terms and conditions, digital platforms ensure that they have their users' consent to utilize their data, which they then exploit for several purposes. First, platforms improve their service and therefore user benefits, trying to keep and expand their user base and hence their market position. A good example of such an approach is Google Search, which collects data from searches to improve its search algorithm. More data lead to a better fit for search results, which makes the search more attractive for both searchers and websites that want to be found. Then, digital platforms also use the data to generate income from a new business model. In the Google Search example, the platform is able to use the data on the number, type and frequency of searches to improve the placement of advertisements. The ability to target advertisements better then allows higher prices to be charged and hence a greater profit margin achieved. In Chapter 4.3 we discuss the relevance of data for digital platforms and competition, including antitrust concerns that arise in this connection, in more detail.

Antitrust regulation becomes particularly important in platform markets due to their tendency to foster a monopolistic structure and their potential misuse of data. An important indicator for competition authorities is whether a market is contestable or not. Digital platforms are able to gain market share quickly, but new entrants are oftentimes able to replace them just as quickly. One ex-

ample of this is the social network MySpace, which entered the market earlier than its competitor Facebook. The incumbent was successful for some time, but was later displaced by its rival within a short period. In Europe, the application of antitrust rules demonstrates that the competition authorities recognize the dynamics of digital markets and consider them in their antitrust decisions. The European Commission approved the acquisition of Skype by Microsoft in 2011, although they would have a share of up to 90 percent of the market for communication services for consumers (Grave/Nyberg, 2017, 364). The Commission argued that the dynamics of that market ensured competition since the entry of new competitors was not only possible but also probable. Even if a digital platform is a monopolist, the market can still be contestable as a result of changes in demand or competitors' innovations, for instance.

Digital platforms' lock-in effects are potential grounds for antitrust concerns, even in cases where there is no monopoly. Binding users to one platform can distort competition by cementing that platform's market position, even if the service offered lacks quality or is sold at a higher price. From a digital platform's viewpoint, lock-in is highly desirable (Shapiro/Varian, 1999, 103 ff.). However, high switching costs make market entry harder for competitors and can thus distort competition. While lock-in effects are not specifically covered by antitrust regulation in Europe, the EU Commission is critical of them. Consequently, the EU General Data Protection Regulation (GDPR), which came into effect in May 2018, guarantees individuals the right to the portability of their personal data. This means that they are entitled to take their personal data with them from digital platform to digital platform. This should reduce lock-in, which is at least partially caused by users' inability to switch their data to another website.

Mergers involving digital platforms are often a cause for antitrust concerns as well. Because some digital platforms have little or no turnover, being organized instead around the collection of data, they do not meet the turnover thresholds of merger control. The most prominent example of this is the acquisition of WhatsApp by Facebook in 2014. Although it fell below the EU turnover threshold (EU Commission, 2014), the EU Commission was able to be review it because it met the thresholds of the antitrust laws of three member states (Spain, the United Kingdom and Cyprus) and thus had a Union dimension.

It is clear, then, that the existing regulation at EU and national levels does not always take the specific properties of digital platforms into account. Germany adapted its antitrust law in 2017 to fit the requirements of digital markets better (Rusche, 2017). One change was that antitrust regulation is no longer restricted to markets that involve monetary payments. This improves the competition authorities' handle on markets where users trade data for a service, as is the case with many digital platforms (cf. Chapter 4.3; Haucap/Heimeshoff, 2018). To a similar end, the German antitrust law now includes a threshold for merger control based on the value of the transactions in addition to the existing turnover thresholds. While this revision of the German antitrust regulation results in a better fit with digital platforms, it also shows the importance of regular revisions of antitrust legislation in general to accommodate the dynamics of digital business models. In addition, competition authorities need to be equipped with greater resources in the form of personnel and technology in order to be able to continue detecting harmful behavior. Depending on the specific conduct and the business model of a digital platform, its abuse of market power or collusion may be hard to detect due to a lack of transparency.

## 4.2 Pricing strategies

Pricing can mean different things for the different types of digital platforms (cf. Table 1, Chapter 2.5). While ad-financed platforms oftentimes do not charge a positive price for the other user groups, platforms exhibiting only positive indirect network effects typically do. We discuss the extraction of data in addition to, or instead of, monetary prices in Chapter 4.3.

### 4.2.1 The subsidy side and the money side

Digital platforms follow specific pricing strategies that often differ from those of other companies. Rochet/Tirole (2006) even define platforms by their price structure. A two-sided market not only includes two different sets of users, but also means that, as well as the price level, the structure of the price affects the volume of the transactions. Even if the sum of prices on both sides of the platform is fixed, the platform is able to increase the volume of transactions by increasing the price for one side and decreasing the price charged to the other. The reason for this is that by using a price of zero to attract many customers to a group with a positive indirect network effect, the platform can

make a more valuable offer and increase the price to the other group, while still achieving a higher volume of transactions. Different prices on the different sides of a two- or multi-sided digital platform are a typical property of those businesses. Evans/Schmalensee (2016) introduce the terms 'subsidy side' and 'money side' of a platform. On the subsidy side(s), the platform offers a free product or service, or charges a price below average cost. This attracts a large number of users on this side. The platform is therefore able to make an attractive offer to the users on the other side(s), where it earns more money, while simultaneously increasing transaction volume.

A simple example demonstrates these dynamics (Rysman, 2004). In the Yellow Pages, companies advertise their service or product for potential customers to find. Consumers in need of a specific service or product use the directory to find a suitable supplier. The Yellow Pages are thus a platform that facilitates transactions between service providers and consumers. While the original Yellow Pages were printed in hard copy, the principle has remained the same and the services of the platform have simply become increasingly digital (The Guardian, 2017). A directory of this type is most attractive for consumers if there is at least one service provider to call for any possible need. Disregarding information overload, the more service providers there are in the directory, the better this is for consumers, since this encourages competition between the service providers. Once consumers have a preferred service provider for a specific purpose, however, they only need the directory very infrequently and their willingness to pay for it is correspondingly small. If a price was charged for access to the directory, only a very small number of consumers would pay it. With a reduced number of potential customers, paying for being listed also becomes unattractive, which ultimately leads to the implosion of the platform. In order to be able to attract paying service providers, the directory therefore needs to attract a broad potential customer base. Thus, the service providers are the money side of the two-sided market and the consumers are the subsidy side. Note that the price structure of a digital platform plays an important role in stabilizing the business model and does not only serve to maximize profits.

Which side to subsidize, and which side to extract surplus from is a strategic decision faced by every digital platform. This decision clearly depends on the characteristics of the market sides, but it is also dependent on the direction

and magnitude of network effects (Rysman, 2009; Evans/Schmalensee, 2007). The market sides are characterized by marginal costs and the elasticity of demand. Clearly, higher costs and low price sensitivity both make it more likely that a platform will charge a user group a price above marginal or average costs. The more sensitive demand is, the lower is the price charged. Positive indirect network effects reinforce these dynamics. If a market side is characterized by a high price elasticity of demand and high participation by this group is very beneficial for the other side, the price charged needs to be low. This group is likely to become the subsidy side of the platform. Rysman (2009) emphasizes that this can also lead to negative prices, i.e. participation can be encouraged by using reward programs. For example, eBay purchases in Germany allow customers to collect so-called "Payback points" that can be accumulated and then exchanged for vouchers or goods.

The determinants of the price elasticity of demand for platform user groups include switching costs and the degree of multi-homing. If switching costs are low, the price elasticity of demand is high. In this case, it is easy to switch to a similar platform. Even if the original platform increased the price by only a little, many users might still switch. In the case of multi-homing, the price elasticity of demand can also be high, since users are already familiar with the competing digital platform. The money side of a platform is usually characterized by a low price elasticity of demand. In addition, indirect network effects – if present at all – are relatively weak or negative. An example of this is the advertising side of YouTube. Viewers watch videos there for the content, not for the advertisements, which might even deter viewers; hence, the indirect network effects are negative.

Digital platforms do not always differentiate between a subsidy and a money side, however. Many of them charge users on all sides, albeit often different prices. One reason for this is that the price elasticity differences between the user groups are small and the magnitude of the (positive) indirect network effects is similar for the different user groups.

### 4.2.2 Monopolistic and competitive pricing

Economists have examined pricing on the money side of a platform from a theoretical viewpoint. If the platform offers a unique service, e.g. it is the only

online directory available, it can act as a monopolist on the money side (Rysman, 2004). This does not directly affect the subsidy side, since a price of zero or close to zero is necessary there to attract a large number of customers and thus improves the position on the money side. However, the subsidy side users would suffer from the smaller number of users remaining on the money side if the platform charged higher prices there on the strength of its monopoly power. Positive indirect network effects would then cause a decrease in the number of users on the subsidy side as well, because the smaller number of users on the money side would lower the platform's utility for them.

Monopolistic pricing by a digital platform leads to higher than socially optimal prices. Microeconomic theory predicts that a monopolist on a one-sided market charges a higher price and therefore sells a lower quantity than a firm in a market with perfect competition. This also holds for multi-sided markets, even when network effects are considered. Although the monopolist is aware of the network effects, i.e. that a higher price on one market side reduces the participation on another market side and the transactions facilitated, the monopolist still uses a mark-up (Rysman, 2004). According to Rysman (2004), the dead-weight loss caused by monopolistic pricing on the money side of a platform can be analyzed in two steps. Firstly, a social planner takes the participation on the subsidy side of the platform – resulting from the monopolistic price – as given. Consequently, he chooses a price lower than the monopolist. Secondly, the social planner is then aware of the fact that lowering the price on the money side even further will attract more users on the subsidy side and therefore increase the willingness to pay on the money side. Therefore, the social planner chooses an even lower – perhaps even negative – price. The welfare loss due to a monopoly compared to the price set by the social planner in the first step is called the classical dead-weight loss (Rysman, 2004). The loss in welfare due to monopolistic pricing compared to the social planner price in the second step is even greater. This additional loss in welfare is called the network dead-weight loss.

In his study of the market for the Yellow Pages, Rysman (2004) calculated the extent of these dead-weight losses for the United States. Note that the median person received two directories from separate publishers (Rysman, 2004, 486). Accordingly, there is only a monopoly in certain parts of the United States.

Rysman finds that the ratio of network dead-weight loss to classical dead-weight loss is 1.26 (standard error: 1.2). Total deadweight loss amounts to 0.43 of equilibrium consumer surplus (standard error: 0.09). Accordingly, the network dead-weight loss is larger than the classical dead-weight loss in this case. For the case of the Yellow Pages, the loss in welfare due to monopoly is around one third compared to the socially optimal level.

Monopolistic pricing is only possible if a platform really has such market power. In many markets, there is severe competition for users by several, often rather similar, digital platforms (cf. Chapter 4.1). In these cases, monopolistic pricing on the money side of the platform is impossible. Very generally, competition should result in a reduction of the prices the digital platform charges and therefore should lead to more transactions taking place. As a result welfare should also increase relative to the monopoly case. However, the effect of competition on prices on the money side and the subsidy side of a digital platform depends to some extent on different factors:

- **The magnitude of indirect network effects.** The larger the positive effect of participation by one user group on another user group, the more valuable for a digital platform is the former. As a result, competition for this user group will be particularly fierce. The competing digital platforms that aim to attract this user group will do so by lowering prices or even offering subsidies for participation. Such intense competition between platforms for a large user base can result in a race to the bottom for the lowest price, especially if the service is homogeneous. Prices can fall below marginal costs (temporarily or permanently on the subsidy side). Oftentimes, the platform with the highest financial backing "wins" the race by pushing the other(s) out of the market or by acquiring them. As soon as competition lessens, the platform adjusts prices upward again.

- **Consumer usage patterns.** Competition can have a large price effect on a single-homing market side and only a small one on a multi-homing side (Rysman, 2009, 131). If users on one side of the platform single-home and a competing platform enters the market, competition for this user group will be particularly fierce. Both the incumbent and the entrant will lower prices (or increase subsidies) for this user group because the market is only

accessible via this group. If users multi-home, they are easier for a new entrant to win over. Consequently, the platform does not need to adjust its price as much to attract such a group.

Not only actual, but also potential, competition can influence the pricing of digital platforms. In a dynamic market environment, a monopolist needs to innovate to retain its market power (cf. Chapter 2.4). Monopoly rents attract new competitors, as do the potential users that the monopolist does not yet serve. Accordingly, the price setting power of a digital platform may be limited, even if there is no currently active competitor. The threat of entry might suffice. This is especially the case in online markets where market entry is relatively easy for new firms (cf. Chapter 4.1).

Digital platforms' pricing strategies can be quite diverse, depending on the setting, framework and business model. Currently used strategies include the following:

- **Usage fee and access fee.** Digital platforms' pricing focuses not only on which side to charge, but also on the structure of the price. The platform has the option of charging a usage fee and/or an access fee (Evans/Schmalensee, 2007, 161). The former is charged when a transaction takes place; the latter is a membership fee and allows a user access to the platform. An access fee might be useful if usage patterns are hard to determine or it is difficult to establish what exactly a transaction entails. This is the case for online dating platforms, for instance. While they could charge their users per transaction – which could mean an initial contact, a date or even a steady relationship – it is much simpler to charge for access.

  Access fees also come into play if the number of transactions is important for the other market side. Evans/Schmalensee (2007) use the example of credit cards. Retailers are interested in turnover and therefore want consumers to pay by credit card often. To encourage this, the use of the credit card for purchases is free for consumers, but they have to pay an annual card fee. In contrast, platforms usually charge a usage fee for transactions the platform can easily identify as such, for example the mediation of accommodation rentals.

- **Dynamic pricing.** Dynamic pricing involves a digital platform's prices changing over time. Initially, platforms usually charge lower prices, which they later increase (Rysman, 2009, 131). The reason for this behavior is that digital platforms have to cross the critical mass frontier – i.e. they need to attract a sufficiently large number of users – on all sides. After reaching such a critical mass by offering a comparatively cheap service that is valuable to the respective user group, the platform can then adapt its pricing and raise its charges. Note that this occurs even if there is competition, although price increases in such cases are bound to be smaller than in a monopoly setting.

- **Bundling.** Bundling entails combining different services in one package that is then offered to users (Rochet/Tirole, 2006). The combination is usually of services or goods that consumers have a different willingness to pay for. This increases revenue for the seller if it includes services or goods that at least some consumers would not otherwise have bought. An example of this strategy is a digital flight comparison platform that also allows hotel bookings at flight destinations, oftentimes at a slightly lower cost than the hotel and flight separately. This way, the platform is able to prevent the multi-homing that could occur if it only offered flights.

### 4.2.3 Price discrimination

If a digital platform is able to deduce a user's willingness to pay from his or her behavior, it can apply price discrimination. This implies that it collects a larger part of the rent associated with a transaction, i.e. it increases revenue and profit while the consumer surplus declines. For a digital platform, it would be ideal to sell its service at the maximum price the user is willing to pay.

Digital platforms are in a better position to assess this willingness to pay because they can closely observe their users' behavior on their websites: what users looks at, for how long and how often they return. With some business models, the platform is able to extract even more information about the user, especially when services are bundled. Take Google Search and Google Shopping, for example. If a user looks up a good or service on Google Search and then goes on to buy it on Google Shopping, he leaves behind information not only about his interests, but potentially also about his income and willingness to pay. The role of data for digital platforms is discussed in detail in the next

section. However, price discrimination by digital platforms raises certain antitrust concerns (BMWi, 2017; Bundeskartellamt, 2016) and we therefore address it here.

Generally, there are at least two kinds of price discrimination that can take place on digital platforms. The first applies to the price charged to users for the platform's own services or products. The second is discrimination with respect to the price of transactions facilitated by the platform. Here, it is mostly the users who are selling a service or good via the platform that initiate price discrimination, although they may be aided in this by the platform itself. Note that the two kinds of price discrimination differ not in the degree of price discrimination, but in who is implementing it.

- **Price discrimination by the platform itself.** Digital platforms implement this form of price discrimination, which affects their contract partners, typically on the money side. If a platform is a monopolist, in the sense that it offers unique access to a desired group of users, it might implement monopoly pricing and skimming strategies. This means that the platform initially charges a high price that extracts the total willingness to pay from the user group with the highest willingness to pay. The platform then gradually reduces the price to capture other user segments with a lower willingness to pay and to extract more of the consumer surplus. From a welfare point of view, skimming is unproblematic, because it helps to increase social welfare compared to a monopoly without price discrimination (Mankiw/Taylor, 2016, 427). However, since most of the welfare increase falls to the monopolist, the distribution of welfare is a challenge.

  Besides monopoly pricing, a digital platform is also able to use prices to react to heterogeneity in the attractiveness of groups to the other market-side(s) (Rysman, 2009, 131). Rysman calls this a "new form" of price discrimination and refers to the example of payment card associations, which attract supermarkets by offering them lower interchange fees than they offer to other retailers. If a supermarket accepts a certain card, using this card becomes attractive to consumers. Digital platforms can thus use different prices to better match the respective platform sides. Price discrimination, therefore, need not reflect an abuse of a dominant market position.

- **Price discrimination by users of a digital platform.** This type of price discrimination occurs on digital platforms that facilitate a monetary transaction between different user groups and refers to the price charged in this transaction. We argued in Chapter 2.1 that a platform facilitates transactions but does not become a transaction partner itself. Accordingly, we have to differentiate between platforms that have a dominant, or at least some, influence on the prices for the transactions they facilitate and those that do not. For example, eBay does not influence the prices of the goods that are auctioned; they are determined by the users that are active on the platform. Digital platforms like Uber, however, do influence prices. They determine the price of a ride as well as the fee the drivers receive. Note that by determining the price of rides, Uber may have violated US competition law (Käseberg/Kalben, 2018, 4).

  Price discrimination by one user group might still be facilitated by the digital platform involved in the transaction, even though it has no part in setting the price. Usually, users that sell their product or service via such a platform are only able to gather information about those users on the other side of the platform with whom they carry out a transaction. That is, the seller can deduce from the ratings a buyer has been given what that buyer bought via a certain platform and when. The seller usually does not have any further information about the buyer that would allow price discrimination, such as what other products a buyer has looked at on the platform. However, digital platforms can change this situation and provide such information, quite possibly at a cost. Even at a price, however, this information can still benefit the seller if the cost of acquiring it is lower than the additional revenue generated by being able to charge different user groups different prices.

  It is necessary to differentiate between services and goods here. Price discrimination for goods may be limited by the possibility of reselling them. Price discrimination for services is easier since the time of delivery plays a greater role and there is usually no time lag between production and consumption.

## 4.3 The importance of data

Data and the use of data are an integral part of the platform business model. Digitalization has made the collection, storage, processing, distribution and analysis of data much easier. While all digital companies benefit from this, digital platforms often are at the forefront of this development. The most prominent example is Google Search, which uses the data collected during searches for various purposes. Firstly, the data extend the algorithm for the search, thereby improving the search results. This is beneficial both for searchers and for the websites they are looking for. Secondly, the data help to direct advertisements to potential customers and hence make advertising on the platform more attractive. Thirdly, the data also generate new business ventures for the platform itself. Take Google Trends, for example, which allows researchers or marketers to map Google searches for specific expressions or words.

### 4.3.1 From data to information

Data and data goods possess a specific characteristic that distinguishes them from other goods: they are cheap to reproduce (Shapiro/Varian, 1999, 3 f.). While it might be costly to produce them – depending on the type of data and the framework for production – their marginal costs of reproduction can be close to zero (Lichtblau et al., 2018, 13). Data are therefore non-rivalrous, meaning that using them does not diminish their usefulness for another party. This property of data makes pricing them more difficult than pricing rivalrous goods (Shapiro/Varian, 1999, 3 f.). Digitalization has not only driven down the cost of reproducing data, it has also dramatically reduced the cost of distributing them (Lichtblau et al., 2018, 13). For this reason, digital economies are often called double zero marginal cost economies.

For digital companies, these properties of data pose challenges as well as bringing benefits. Digital platforms reap the latter particularly well. According to the OECD (2013), the use of data has five benefits for digital companies. Note that these are generally valid for all companies that possess data, not only for digital platforms.

- **Enhancing research and development.** Data provide digital platforms with knowledge about their users' behavior. They are able to assess how often users have clicked on a specific advertisement, for instance. This allows

digital platforms to identify which features of an ad make it attractive to which users. They are then able to exploit such information to develop new types of advertisement or to show them in an optimal sequence.

- **Developing new products.** Digital platforms also use the data collected on transactions and users to develop new products. These products can be data themselves or a product that the data are a vital part of. Google Trends is one example of the latter.

- **Optimizing production or delivery processes.** Digital platforms use data to improve the quality of matches between the market sides. Data also enable them to lower transaction costs and thereby to increase the number of transactions.

- **Improving marketing.** Data allow digital platforms to distinguish different user groups or even different individual users. Web tracking helps to create a profile of any user (Arnold/Hildebrandt, 2016, 5). This makes possible personalized marketing in form of individually placed advertisements or personal recommendations. Thus digital platforms are able to reach the target group of a marketing campaign more efficiently and more reliably.

- **Developing new organizational and management approaches or significantly improving existing practices.** Besides the benefits mentioned above, and depending on their exact nature, data allow digital platforms to improve their own internal processes, organization and management. Data might reveal that a platform's organizational structure is neither likely to be successful nor the best fit to what users need or expect. In dynamic markets where competitors are striving to maintain or increase market share this might well make a crucial difference.

Digital platforms are potentially able to monetarize a larger amount of data than other business models. In some markets, this may be a competitive advantage that digital platforms can utilize to gain market share. Many platform businesses not only use the data that they generate themselves, but also combine their own datasets with data from other sources to create extra value. Digital platforms may become so focused on accessing data that it drives their

business decisions. A lot of the controversy surrounding the Facebook-WhatsApp merger was due to concerns that Facebook would use WhatsApp's data to its own advantage (e.g. Miller, 2016, 6 f.). However, collecting and storing data is only the necessary condition for reaping benefits, since they do not create value on their own. The sufficient condition for using data for business success is being able to extract information from them (Aggarwal et al., 2016).

Much of the data that digital platforms in the B2C sector collect, store and analyze are personal data, which are usually particularly sensitive. The users of a platform – typically on all sides – must consent to the use of their data. Especially in the absence of a monetary payment (cf. Chapter 4.2), users "pay" for the service with their data. Despite the stricter regulation of the use of personal data imposed by the GDPR from 2018 on, the use of personal data remains a sensitive issue. Two important aspects of data use warrant particular attention:

- **Responsible handling of personal data.** Digital platforms are usually asset-light business models (Demary, 2017, 5), which need their users' data to successfully facilitate transactions. However, users will only provide their personal data if digital platforms handle them with the utmost care. This means that platforms must act responsibly with regard to when and how they are utilized, including protecting the data from cybercrime or misuse within the platform business. Antitrust concerns are also widespread (cf. Chapter 4.3.2).

- **Transparent terms and conditions.** Complicated phrasing deters users from actively reading the terms and conditions before agreeing to them. Lock-in effects due to high switching costs can further contribute to users neglecting the terms and conditions. Transparency can be an important factor for platforms: The GDPR requires, among other principles, transparency and fairness when processing personal data. Besides, transparent terms and conditions can be a distinctive feature for platforms which can help them in competition.

Data ownership is a particularly relevant issue for digital platforms here because it determines how the use of data is regulated. Firstly, as an intermediary, their business model is dependent on data. Secondly, they are able to collect, com-

bine and analyze relevant data from all market sides. Finally, they are then able to use these data to create new business models. Generally, the question of data ownership requires a distinction between personal and non-personal data (e.g. Bundeskartellamt, 2017a, 2). When processing (including disclosing) personal data, a digital platform is bound by the corresponding data protection laws. In the majority of cases within the European Union, the processing of personal data is only allowed if the data subject has given consent (Article 6 (1) GDPR). Furthermore, the GDPR makes processing of personal data subject to the following principles (Article 5 GDPR):

- lawfulness, fairness and transparency,
- purpose limitation,
- data minimization,
- accuracy,
- storage limitation,
- integrity and confidentiality,
- accountability.

For consumers, the sensitive use of data by online platforms is of paramount importance. For instance, in a survey for the European Commission (2015b, 23) which asked consumers about their concerns when using online banking or shopping online, 43 percent were worried about someone misusing their personal data. This percentage is particularly high considering that this was a free text question with no options to choose from. Other prominent answers were security concerns in connection with online payment processes (42 percent) and a general preference for conducting transactions personally rather than online (26 percent).

Non-personal data, in particular machine-generated data, are also highly important for many digital platforms. Data ownership in this case is not as clear-

cut. Although there is a lack of EU-wide regulation, in Germany the right to collect and use non-personal data can be clarified in the contracts concluded by the transaction partners (Ensthaler, 2016, 3474). Right of ownership of non-personal data could be decided on the basis of the German Civil Code (BGB), in which case it would then be analogous to the handling of raw materials (Enstahler, 2016, 3475 f.). Consider this example: A firm mining and selling iron ore retains title neither to the steel produced from it nor to the products made from that steel. With respect to data, a firm installing devices into machines to collect data, which it then uses for research and development, is the rightholder of the respective goods and services created out of these data, even if the machine in which the device is installed is being used by another company. Nevertheless, the firm "producing" the raw data by using the machine could demand compensation for the data collected that would need to be determined in an agreement between the parties involved.

### 4.3.2 Antitrust concerns

Digital platforms' use of data raises even more antitrust concerns than their other characteristics. A unique dataset grants a platform – or any other digital business model for that matter – power that they could abuse. Examples of such abuse include firms charging individualized prices, establishing and abusing market power, and acquiring small firms with valuable datasets – such as startups – to suppress innovation and to improve their own competitive position even further. The competition authorities and other public institutions are aware of such fears and attempting to address them (BMWi, 2017; Bundeskartellamt, 2017a).

High quality data may allow a digital business to improve its product or service and thus increase its market power. Especially in oligopolistic markets, the greater transparency provided by data can also lead to anticompetitive practices. Transparency means that competitors are able to observe a digital business's pricing in real time and use the data to retaliate immediately. This can reduce the profitability of a price decrease. However, research on the highly oligopolistic market for gasoline in Germany has shown the opposite. Ever since a public transparency agency for gasoline prices began publishing price changes almost in real time, competition has increased (Haucap et al., 2017). More market transparency is hence not necessarily a threat to competition.

Contrary to common belief, market power created by data need not be a reason for antitrust concerns. In the opinion of the German competition authority, for instance, the role of access to data in the success of a firm dominating a certain market is overrated (Bundeskartellamt, 2017a, 11). We argue that there are three reasons why this could be the case.

Firstly, the marginal utility of data is declining, as even Google concedes (Grave/Nyberg, 2017, 367). The greater the volume of data, the higher are the costs for storing, processing and analyzing it and the smaller is the improvement provided by those additional data. This particularly holds if the variety of the data is low. Consequently, a digital platform might use only a subset of the data instead of the whole dataset without detriment to the volume and quality of the transactions facilitated. Furthermore, it is likely that – even when used in a non-rivalrous context – data lose value over time. Indeed, Körber (2015, 132) states that, over time, user data lose their value exponentially. Using the example of weather data, Arnold/Hildebrandt (2016, 3) argue that a loss of data value is context-dependent. While a forecast of a storm, for example, is highly valuable, historical data on the same storm are worth comparatively little. Consequently, the problem of market power and lack of competition due to the role played by data could resolve itself over time (Körber, 2015, 132).

Secondly, two conditions have to be fulfilled simultaneously for data to be causal in the creation of market power (Bundeskartellamt, 2017a, 7):

- Access to specific data is important for economic success in a market.
- The other players in the market are not able to buy or collect a set of data that is similar to, or at least as useful as, the initial dataset.

Most consumers use different digital platforms for different purposes. Therefore, the personal data they provide to the platform enterprise are non-exclusive. For instance, Google Search is used for both general and specific searches, Amazon for searches for books, clothing and electronics and Etsy.com for searches for home-made apparel. A user searching for a piece of clothing might very well use all three platforms (or even more) and leave data similar to those created in search queries. Moreover, even traditional firms, such as banks,

phone companies and retailers, collect data. All firms thus are in a position to create a high quality dataset. Hence, the number of cases where both the above-mentioned conditions are fulfilled is likely to be rather small. Grave/Nyberg (2017, 365) were unable to find a single case in antitrust case law of a market leader being convicted for not providing access to their data. Moreover, the GDPR further reduces the likelihood of exclusive datasets. It defines personal data as "any information relating to an identified or identifiable natural person" (Article 4 (1) GDPR) and grants users the right to data portability for their own personal data (Article 20 GDPR).

Thirdly, as suggested above, data alone are no more than raw material. Digital platforms' success is mainly dependent on the algorithms they use to process data and to extract valuable information from them. Suppose that a firm has a high quality dataset. A competitor with a better algorithm could still be more successful in the market, even if their data were of lower quality. In the market for online searches, for instance, Google Search has been able to become a monopolist in Europe and a dominant platform in North America by using its algorithm to create a better product. Before Google Search even entered the market, the incumbent search engine Yahoo! had already collected a great number of search queries to extract relevant information from and should have had a better quality dataset due to its market leadership. Nonetheless, Google Search was able to supplant Yahoo!. To some extent, a high quality algorithm seems to be able to compensate for poor data quality and vice versa: A good algorithm may be able to extract valuable information even from a low quality dataset, while a high quality dataset may be able to compensate for an algorithm with weaknesses. Of course, a digital platform generally needs both good data and good algorithms to be successful.

Nevertheless, a digital platform is able to use its market power to set adverse rules for its users. For example, a platform can use its terms and conditions to grant itself the right to extract data from its users, and use them to generate income. Especially if the monetary price charged on one platform side is zero, this might be a way to abuse a dominant market position, a danger highlighted by the German competition authority (Bundeskartellamt) when launching its in-depth investigation into Facebook's use of possibly unreasonable general terms and conditions (Bundeskartellamt, 2017a, 12).

## 4.4 Transparency

Transparency, or a lack thereof, can be vital for digital platforms' success in the marketplace. The advantages of transparency in a digital platform's activities are numerous. Specifically, transparency can be used

- to overcome the anonymity of the internet and users' consequent lack of trust (Demary, 2016, 16; OECD, 2017, 129),
- to dispel users' worries about misuse of their data (Demary, 2016; OECD, 2017, 127)
- to overcome information asymmetries between platform and user (OECD, 2017, 128).

While transparency is advantageous for users of digital platforms, the platforms themselves sometimes prefer a different approach. Take a digital platform facilitating transactions between two different types of users, for example. The platform is able to gain influence over these transactions by limiting the number of choices and/or by displaying the results in a specific sequence. In this way, the platform can manipulate users. If users are unaware of this lack of transparency, they are being misled. From the platform's point of view, however, it might still be very useful. This example of anticompetitive behavior demonstrates that transparency in digital platforms' activities, while holding advantages for users, may not be the first-best solution for the platform business itself. In the following we therefore analyze the interactions between users and between platform and users separately.

### 4.4.1 Transparency between users

A lack of trust between the transaction partners is notably common in peer-to-peer transactions (Demary, 2016, 16). Digital platforms facilitate transactions between users who can be situated anywhere. The information available to users about other users is confined to what the platform displays. While this is particularly a barrier to transactions between individuals, it also influences transactions between business users and individual users, albeit to a lesser extent. The lack of personal contact in digital transactions and the lack of opportunity to verify the information displayed about the other parties can

discourage users from using a digital platform. Possible concerns include the misuse of personal data and fraud. This trust barrier can reduce the number of transactions facilitated by the platform, and, in that sense, endanger the whole business model.

Digital platforms thus have a strong incentive to increase the level of trust between their users. To overcome the anonymity of the internet and to dispel potential users' worries, online platforms use one or more of the following approaches (OECD, 2017, 127):

- **Review and reputation systems.** Under these systems, users are usually able to rate the transaction and their transaction partner on a set scale or to write a review. The ratings and reviews are then published alongside the respective users' other information. When potential users view these ratings and reviews, they are better able to make an informed decision about a transaction or the respective transaction partner. Review and reputation systems need to be designed carefully to avoid fake reviews, peer pressure or an inflation of ratings.

- **Guarantees or insurance.** Depending on the transactions facilitated, many digital platforms offer a guarantee or insurance – often as an automatic part of a regular transaction. If a transaction goes wrong – a product is not delivered to the buyer, for instance – the platform's guarantee becomes effective. This simplifies transactions and makes them less risky for the users.

- **Verified identities.** Many digital platforms offer, or even require, a verification of users' identities. They either use social media accounts or identity cards to ensure that users are who they say they are. This is especially helpful in resolving disputes, but it also helps to exclude fake accounts, for instance on social networks or on dating platforms.

- **Pre-screening.** Depending on the business model, it can be useful for a digital platform to check the users according to a predefined set of rules before allowing them access to the platform. A good example of this is the checks of motor vehicle records that are used to help recruit safe drivers as peer-providers or for ridesharing services.

- **Secure payment systems.** If a digital platform organizes not only the transaction, but also the payment involved, it usually offers a secure payment system. In the EU, 42 percent of users have security concerns with respect to online payments (EU Commission, 2015b, 23). Offering a secure payment system thus helps to enhance the number of transactions made on a platform.

- **Education, checklists and forms.** Often enough, lack of trust in their knowledge of the legal issues around activities on a digital platform will deter individuals from becoming users. Information about their obligations in the form of checklists, forms or general education texts can help platforms to achieve a larger user base.

Some of these measures, such as review and reputation systems, verified identities and pre-screening, clearly contribute to transparency. Crucial information about the transaction partner is collected and displayed and their general behavior in other transactions is revealed.

Guarantees, insurances and secure payment systems make potential problems transparent and offer solutions. Since these measures aim to increase a digital platform's user base, implementing them is in every platform's self-interest. However, the design of the measures and their communication by the digital platform strongly affects their effectiveness. Also, while increasing transparency, such measures cannot generally prevent fraud, theft or misuse of data. For instance, personal data exchanged via the platform could still be stolen by hackers and used to create a fake account on other platforms and/or to commit further crimes. Nevertheless, these approaches help digital platforms to become a trustworthy medium for transactions.

### 4.4.2 Transparency between platform and user

Transparency is also crucial for the relationship between the digital platform and its users. The main reason for this is an information asymmetry between them: The platform generally possesses more knowledge than its users. It collects and uses data and it organizes transaction partners and transactions in a specific way. Users are mostly unable to fully grasp these methods or procedures due to a lack either of transparency or of interest. Often enough,

digital platforms are transparent in the sense that they inform users about these issues and thus reduce the information asymmetry. Sometimes, however, digital platforms refrain from doing this to advance their business interests.

The OECD points out that the service offered by digital platforms often is a "credence good" (OECD, 2017, 128). This means that a user, especially one that does not multi-home, is unable to judge the effectiveness of the service. For instance, an individual using Google Search does not know all the criteria actually implemented for the search and the ranking of the results. This makes it hard to distinguish between paid advertisements and genuine search results. The question is whether or not a digital platform should decrease this information asymmetry by making at least some of the criteria for the matching process transparent. While there is some (quasi-)regulation that has already increased transparency – such as insistence on the flagging of advertisements as such – there are still many information asymmetries between digital platforms and their users.

Deciding how much information asymmetry is tolerable is a matter of balancing the interests of consumer protection and the protection of the digital platforms' business model. It is essential that the business practices of digital platforms do not harm consumers. At the same time, part of the information asymmetry could be the core of the business model. Take the algorithm of a search engine, for example. While some call for its publication in the interest of users, it is the search engine's most important business secret in its competition with other suppliers of the same service. Demanding transparency in this case would mean affecting, if not harming, competition. It would also seriously impair the incentives for digital platforms to invest in innovation, since the latter would be easy to copy.

However, there is a fine line to be drawn here. A digital platform could use the information asymmetry to illegally privilege its own services or specific transaction partners. An EU Commission decision demonstrates that this is not just a theoretical argument. In 2017, it levied a fine of €2.42 billion on Google for systematically privileging its own comparison shopping service over other shopping results (EU Commission, 2017b).

As explained in Chapter 4.2, users on the subsidy side of a digital platform may be offered the platform's service free of charge. However, the platform collects their data in order, among other reasons, to be able to make a more valuable offer to the users on the money side. Although this may be stated in the terms and conditions of the platforms, users on the subsidy side sometimes unknowingly "pay" with their data. Oftentimes, they complain about the lack of privacy while still exchanging their data for digital services, a phenomenon known as the "privacy paradox" (Engels/Grunewald, 2017). The privacy paradox may be the result of a trade-off: The stronger the preference of a user for privacy, the more often they will use platforms that collect less data. However, due to positive network effects and the quality of the service offered, platforms collecting more data can be so attractive that consumers feel compelled to use them (Engels/Grunewald, 2017).

In the European Union, the lack of transparency about the use of personal data is addressed by the GDPR, in which the EU Commission introduced the concepts of "privacy by design" and "privacy by default" to increase data security standards (Engels/Grunewald, 2017). Privacy by design means that "the controller shall, both at the time of the determination of the means for processing and at the time of the processing itself, implement appropriate technical and organisational measures, such as pseudonymisation, which are designed to implement data-protection principles" (GDPR, Article 25 (1)). To ensure privacy by default, Article 25 (2) codifies the obligation to ensure that, by default, only personal data necessary for the relevant process is processed. Thus the EU Commission aims to restrict digital businesses' opportunities to abuse market power by collecting extensive data. Other European competition authorities have opened investigations into this topic. One example is the German competition authority's investigation of Facebook due to its collection and use of data from third-party sources, such as Instagram, that are owned by Facebook or independent businesses that have an agreement with it (Bundeskartellamt, 2017b).

This demonstrates how highly European competition authorities value digital platforms' transparency with respect to their use of data. If they are to avoid investigations into their business practices, digital platforms need to be as transparent about their collection and use of data as possible. Platforms with

an extensive user base are particularly likely to be investigated because of the large number of individuals affected.

Of course, there is an intrinsic motive for greater transparency between platforms and their users as well. By being more transparent, platforms are able to establish more trust in the relationship between them and their users, enabling them to increase the number of users and transactions correspondingly.

On the other hand, while digital platforms benefit from transparency, they also have an incentive to maintain or even increase information asymmetries. This does not necessarily warrant competition authorities' attention unless it does in fact distort competition. To sum up, digital platforms need to balance consumer protection and the protection of business secrets.

# 5 Policy recommendations

Digital platforms are a business model like any other. At the same time, they exhibit very particular characteristics. It seems highly unlikely that there is a general shift to a platform economy where this business model dominates all markets. Platforms are superior to other business models when it comes to reducing transaction costs and are therefore likely to occur in markets with high transaction costs. However, any platform depends on users on all of its sides. These users can – as in many of the examples put forth in this analysis – be individuals. They can also be other businesses, mostly traditional ones. There is still huge potential for digital platforms in the business-to-business environment. In the aggregate, digital platforms complement traditional companies rather than replace them.

Some of the unease about, and fear of, digital platforms (BMWi, 2017) is therefore unjustified. Instead of trying to limit their influence by regulation, policy-makers need to realize their potential for every economy. This is not to say that they do not need to be supervised. On the contrary, the dynamics of digital platform business models call for close supervision. Still, in general, digital platforms offer such huge opportunities for the economy that these

business models should be fostered. In particular, the following recommendations for national and EU policy can help to unleash the potential of digital platforms while keeping in check their market conduct:

- **Enforce existing antitrust regulation.** The existing antitrust policy at EU level and at the level of the member states covers many of the challenges to competition that digital platforms cause. It is vital to enforce this regulation and to do so quickly, so that digital platforms that abuse market power or make questionable acquisitions can be rapidly countered. While the competition authorities are already aware of this and are acting accordingly, the dynamics of digital platforms and the large number of affected markets call for speedy responses on many fronts.

- **Keep a watchful eye on the resources of competition authorities.** Digital platform markets are very dynamic. Network effects and the increased use of data necessitate close supervision of digital platforms by the competition authorities. While some authorities have already reacted by installing the appropriate task forces (e.g. Bundeskartellamt, 2015), their resource endowment should be monitored to ensure that they are able to perform this function adequately. In addition, new concerns may require an increase in resources. If, for instance, algorithms cause collusion over prices (Ezrachi/Stucke, 2016, 35 ff.), some competition authorities may already be equipped to handle this sort of challenge, but others might need extra resources or an appropriate legal framework.

- **Enforce the General Data Protection Regulation.** The GDPR introduces generally valid principles for collecting and processing personal data in the European Union. This creates a level playing field for platforms and other businesses where they can compete equitably. Furthermore, the right to portability of one's personal data as specified in the GDPR can reduce lock-in effects and change costs in consumer markets. It is therefore vital to ensure efficient enforcement of this regulation and impose fines where necessary.

- **Clarify the use of non-personal data.** Companies such as digital platforms often possess massive amounts of non-personal data that could be used to

organize processes more efficiently or design new products or services. The use and ownership of such data is not always clear-cut. To foster the exploitation of these data, policy-makers need to focus on creating greater legal certainty in this area.

- **Promote growth of small and medium-sized enterprises.** For small digital platforms, increasing the number of users in order to reach critical mass is a paramount priority. Policy-makers should therefore reduce the bureaucratic barriers for start-ups and generally work to improve venture capital availability so that it becomes easier to found a company and keep it afloat until the critical mass frontier can be crossed.

- **Improve user awareness.** While the pricing schemes of digital platforms often offer their service free-of-charge to one side, users need to be aware of the terms and conditions they agree to by using the platform. Responsible handling of one's own data needs to be taught from an early age. From their first contact with the internet, school students need to acquire such digital awareness and responsibility. This requires investment in the education system, and in teacher training in particular.

- **Strengthen consumer trust.** Digital platforms can greatly reduce transaction costs and increase efficiency if the number of their users reaches critical mass. Trust in the platform and its dealings is a prerequisite for this. Many digital platforms use reputation mechanisms or other means to gain their users' trust. It could be helpful to support this further by offering an official quality label, for instance. This would increase transparency as well.

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# Zusammenfassung

Digitale Plattformen dominieren bereits heute die Top 10 der weltweit wertvollsten Unternehmen. Doch die spezifischen Merkmale des Plattformgeschäftsmodels, wie schnelles Wachstum und die damit erreichbare Marktmacht kurz nach Markteintritt, haben zu öffentlichen Diskussionen geführt. Die vorliegende IW-Analyse hat sich zum Ziel gesetzt, die Grundlagen des Erfolgs von Plattformen und die damit einhergehenden Herausforderungen zu analysieren. Dabei wird unter einer digitalen Plattform ein webbasierter Intermediär verstanden, der Transaktionen zu stark reduzierten Kosten ermöglicht und dadurch einen Mehrwert für Kunden generiert. Digitale Plattformen sind sich zudem der wachsenden Bedeutung von Daten bewusst. Durch das Sammeln und Kombinieren von Daten verschiedener Nutzergruppen können sie ihre Leistungen für ihre Kunden verbessern und neue hinzugewinnen. Doch die Marktmacht digitaler Plattformen und ihr Zugriff auf große, wertvolle Datensätze haben bereits zu Untersuchungen, Verfahren und Strafen geführt. Ziel der Wirtschaftspolitik in diesem Zusammenhang sollte sein, die Konsumenten zu schützen und gleichzeitig Plattformen zu fördern.

# About the authors

Dr **Vera Demary**, economist (B.A., M.Sc.), was born in 1981 in Gütersloh, Germany. She heads the "Structural Change and Competition" research unit at the Institut der deutschen Wirtschaft (IW; German Economic Institute). Since joining the institute in 2009, she has worked in several positions, focusing on innovation, education and labor shortages. Her current research is on digitalization and competition. Prior to her work at the IW, Dr Demary was a research assistant at the University of Cologne, Germany.

Dr **Christian Rusche**, economist (Diploma), was born in 1984 in Sangerhausen, Germany. He is a member of the "Structural Change and Competition" research unit at the IW. His research focuses on the competition effects of digitalization. Before joining the IW, Dr Rusche worked as a research assistant at the Technical University of Dortmund, Germany.