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An Economic Policy Perspective on Online Platforms

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Abstract

This report provides an overview of the relevant economic research literature on platforms or multi-sided online markets. It discusses platforms from a regulatory policy angle, including potential market failures in platforms, the extent of self-regulation and possible regulatory responses through existing competition policy, consumer protection and data protection instruments. It covers selected policy issues associated with these platforms including possible sources of bias in search engines and search rankings, data protection and the use of personal data in platforms, and platform liabilities within and beyond the e-commerce directive.

Executive Summary

The economics of platforms

In economics, platforms are known as "two-sided" or "multi-sided" markets where two or more types of users are brought together by a platform to facilitate an exchange or a transaction. Users can be buyers and sellers, advertisers, software developers, social media users, etc. Offline platforms have existed for millennia, for instance as village markets. Online platforms thrive on the dramatic decline in digital information costs that enables many exchanges that were not feasible in offline markets because of high information costs. This generates economic benefits for all users.

There is no consensus definition of platforms. Economists initially became interested in platforms because of the indirect network effects that they may generate: bringing more users on board on one side of the market requires more users on the other side. To overcome this "chicken and egg" problem, platforms may subsidize access for one type of users (typically the side that is more price sensitive) and overcharge another type (that is less price sensitive). The magnitude of network effects varies widely across platforms and is an empirical question. The historical focus on network effects and unorthodox pricing strategies triggered competition policy concerns about platforms. However, evidence of the past 10-15 years shows that there is lively oligopolistic competition between platforms, or even within platforms, driven by technological progress. Many platforms that once dominated their market have been superseded by competitors (examples: MySpace, Nokia and Blackberry, Windows) while several main players today (Apple, Google, Facebook) were small fish before 2010. There is no guarantee that these churn rates will continue in the future. It shows however that market dominance is not guaranteed in an environment with fast technological change.

More recently, economists have argued that network effects are not the most important characteristic of platforms. Platforms can be more narrowly defined as a place where two or more types of users can directly interact with each other, facilitated and observed by the platform operator. For instance, on AirBnB real estate owners and clients can interact directly to conclude a deal. This distinguishes platforms from retailers where no direct interaction is possible, or from vertically integrated firms that integrate one side of the market under a single ownership structure. Platforms have led to the emergence of sharing or collaborative economy platforms where consumers can trade directly with each other. Some platforms operate hybrid business models that combine these characteristics[1].

Platforms complement and erode the traditional firm on two sides: large online market places put pressure on price margins and micro-enterprises in the collaborative economy may erode traditional forms of production and work inside a firm. The existing regulatory framework is designed mostly for traditional firms. Regulatory initiatives that target online platforms and their corollary, the collaborative economy, face a trade-off between defending existing business models (and existing employment) in traditional firms or defending innovative new models that may generate wider benefits.

Monitoring and facilitating direct interaction between users opens the door to a key aspect of online platforms: economies of scope in data collection and analysis. In a pure form, platforms offer an information service only, helping users to find each other in order to conclude an exchange. That puts them in a privileged position where they can observe and collect data on user behaviour, across all users and different sides of the

[1] Amazon is both a retailer and a platform; it is also a vertically integrated firm that operates warehouses and logistics services. Apple produces hardware and software. Netflix produces and distributes films. These platforms are vertically integrated production chains on one side of the market. They may operate as a retailer for another part of the market and have a true platform market place for still other parts of the market.

market. The aggregation of this information gives them a comparative advantage over individual users. It also deepens the information asymmetry between platform and their users on all sides of the market. That benefits users but may also cause concern that information might be used to their disadvantage.

Search rankings

The comparative advantage of online platforms resides in their ability to match users on different sides of market by means of the personal and business data that they collect and exploiting the economies of scope inherent to large data sets. Data-driven matching tools include paid ads, commercial search and organic search. Search rankings have their own problems however.

First, all search rankings inherently suffer from "superstar economics": more popular choices remain more popular because they appear at the top of the ranking. It may lead to lock-in of popular products, especially for users who want to minimize search costs. Users can overcome this only by means of more directed search, comparing different search engines and product discovery channels.

Second, empirical evidence shows that commercial search engines, just like any other firm, strike a balance between user preferences and their own profit objectives. They drive a wedge between buyer and seller welfare on the one hand and the welfare of the search engine operator on the other hand. There is also evidence that platforms cannot push this bias too far because users will switch to other platforms. This is not necessarily a market failure that requires regulatory intervention. The Unfair Commercial Practices Directive applies to consumers as natural persons, not to platform users as legal entities who may also suffer from excessive bias in search rankings, including in paid ads.

Third, positions in search rankings and paid ad rankings also determine market access for firms that depend on online distribution channels. Ad rankings may also suffer from bias in favour of the platform operator. While targeted advertising continues to be an important online business model the jury is still out on its potential benefits for firms and for consumers – not for platform operators.

Fourth, organic search in general search engines should not be polluted by the commercial interests of the platform. If there are suspicions that it is polluted (platforms promoting their own products or deliberately harming competitors' interests) competition policy tools can intervene (re the on-going Google Search case).

Finally, even in pure organic search there is no "search neutrality". Search inevitably hovers between an objective "conduit" of information and a more subjective "editing" of results. This is not a market failure; it is hard to see how regulators could improve organic search rankings. Search neutrality remains elusive because it cannot be objectively defined from a social welfare perspective.

The use of data in platforms

The "one-way mirror" metaphor illustrates the widening information asymmetry between virtually unlimited personal data collection and processing capacity in digital platforms and the limited cognitive capacity of human users. While this generates benefits for users, it also raises concerns about loss of individual autonomy, lack of transparency and accountability and the possibility that the data might be used against users' interests.

Data have particular properties that distinguish them from ordinary goods and services: they can be used by several parties at the same time (non-rival) and it is hard to give exclusive property rights to data (non-excludable). This complicates attempts to protect personal data or assign exclusive ownership rights to personal data. It may also lead to widespread market failures in data markets and the need for regulatory intervention. In the EU, lawmakers have opted for personal data protection rights, including the right to access, modify and delete personal data held by platforms and "informed consent" by

individuals to allow platforms access to personal data and restrictions on secondary use of personal data.

Personal data are not only collected & used by platforms but also traded in a complex ecosystem of global data markets. Real-time and processed personal data may fetch premium prices or may not be traded at all. Personal data are used for consumer profiling in commercial and organic search rankings. That reduces search costs and may generate considerable benefits for all parties. They may also create costs because of various behavioural biases that they may induce and nudge users into decisions that they may regret. There is no evidence so far of regular use of personal data for personalised pricing on platforms however.

Privacy protection leaves users with a dilemma. It is very hard for individual users to understand what data are collected and how they will be used, let alone make an objective assessment of the costs and benefits of protecting or releasing their personal data. Privacy protection by means of "informed consent" is not only costly for users but also ineffective because of these knowledge constraints. Users often voice their concern about privacy but do not behave accordingly, not because they are risk-loving but because their economic assessment of the costs and benefits of privacy protection drive them in this direction – known as the "privacy paradox".

Data are subject to economies of scope: larger and more varied datasets often yield more insights that smaller and separated datasets. Platforms thrive on these economies of scope because it enables them to make better matches between users on different sides of the platform market. This leaves policy makers with a dilemma: should they allow more integration between datasets held by individual firms, through mergers or trade – in order for society to reap the benefits of economies of scope – or should the restrictions on secondary use in the GDPR be interpreted more strictly? Privacy and data protection has welfare implications for society as whole but also welfare distribution implications between different users groups and the platform operators. There is so far very little empirical evidence that can clarify trade-offs in private behaviour and in policy making.

There is also growing information asymmetry between content producing firms and the platforms on which they market their goods and services. Firms, especially innovative start-ups, may face problems to access data held by platforms or other firms; that may blocks downstream innovation. Competition authorities in the EU and US have so far been very prudent in considering data access cases, often with the argument that there is a vibrant market for data and substitute sources are available. There is no consensus among researchers whether data markets face significant bottlenecks or not and whether current competition policy tools are sufficient to deal with data mergers and refusal of access to data. The debate revolves around the question of availability of substitute data sources.

Like consumers, firms may also lose control over the use of their data on platforms. Platforms thrive on data collection and analytics and may use this against the interest of suppliers to the platform. The EU General Data Protection Regulation (GDPR) gives natural persons a right to access personal data, withdraw them and require consent for the use of personal data. It does not protect the rights of firms to their data on platforms. Similarly, the Unfair Commercial Practices Directive (UCPD) applies only to consumers, not firms as users on platforms. Since firms are also "users" on platforms, consumer protection might be widened in modern digital economies to cover all types of platform users. Competition law only protects firms against dominant market players. This leaves a gap in business-to-business data practices.

There is also growing information asymmetry between platforms and regulatory authorities. Society could benefit from enhanced enforcement of existing competition, data protection and consumer protection regulation. This could be achieved with the support of a data authority, equipped with specialist data analytics staff and

infrastructure, working under the auspices and the legal mandates of the existing authorities, to help with specific cases and improve monitoring and reporting on a more permanent basis.

Platforms and intermediary liabilities

We distinguish between liabilities for illegal content in the context of the EU e-Commerce Directive (ECD) and, beyond the ECD, wider platform liability for the application of legal and regulatory provisions that apply to exchanges of goods and services.

With regard to illegal copyright-protected content, online platforms have opened up possibilities for new forms of media content production and distribution that puts pressure on revenue streams in existing media business models. Some of these platforms are fully licensed, others only partially or not at all. With regard to wider platform liability for rules applying to transactions in goods and services, it should be noted that many online platforms reduce information costs and give users access to a much wider variety of opportunities for exchange. Without improved liability management this will necessarily increase ex-post risks in transactions and raise questions of liability. Platforms are acutely aware of this issue and have made substantial efforts for improved self-regulation of the market, leveraging their information collection and processing capacities for that purpose.

This raises the question of the robustness and credibility of self-regulation. Consumer reviews and rating systems are not problem-free and can be biased. There is empirical evidence on the use of strategic behaviour in ratings (gaming of the ratings by spammers, collusion and reciprocity in two-sided ratings) and on the under-supply of ratings (because they are a public good and frustrated users are less likely to return to the platform to leave a rating). Reputational ratings contribute to a reliable measure of quality and consumer protection. Some ratings are fairly robust, others suffer from biases, often induced by commercial interests. Ratings are a public good that enhances transparency and reduces asymmetric information in a market.

In principle, more detailed information collected by platforms at the user level could produce more reliable insights than centralised offline regulatory standards with high entry costs. However, the evidence is inconclusive and varies considerably from platform to platform. This may suggest that there is a role for public sector regulators to supervise the quality of sector-specific attempts at self-regulation and possibly set meta-standards for self-regulation of search rankings, consumer ratings and contingent liabilities without intervening directly in the self-regulation efforts.

Self-regulation through rating systems cannot mitigate accident risks that are outside the control of any of the parties on a platform. This requires appropriate insurance schemes that can be provided by insurance markets. This is an area where insurance and liability law, and consumer protection legislation, could be re-examined and adapted to online platforms, in particular collaborative economy platforms that may fall outside the scope of the regulatory framework for traditional firms.

The emergence of news types of online (collaborative) platforms has led to some substitution in activity between traditional firms and new market places. This has triggered calls for the creation of a regulatory playing field between traditional and new online market places. Some have called for a wholesale extension of existing regulatory frameworks, or at least a partial extension that could lead to market fragmentation between smaller and larger producers of online services.

It would be preferable to first of all take into account the capacity for online platforms to auto-regulate their specific markets. That may of course lead to new types of market failures in search rankings, review ratings and the management of contingent risks in transactions. This might require meta-regulation of these potential market failures. Again the message is that regulation should not protect incumbent business models but support welfare-enhancing innovation.

1. Introduction

The rapid growth in the number of online businesses has produced many benefits for consumers and firms. It gives consumers easier access to a very wide variety of products and services, much more than offline shops can provide, and often at very competitive prices and attractive delivery conditions. It gives firms access to a potentially much larger consumer market and much more online shelf-space than any offline shop can offer. At the same time, the growth of some of the most successful online businesses, as well as the data collection and use practices of some of these, have become a source of concern for citizens and governments. The rise of consumer-to-consumer or peer-to-peer sharing/collaborative economy platforms has added further regulatory challenges in online services.

Many of these fast-growing online businesses are multi-sided markets or platforms where two or more types of users (consumers, suppliers, advertisers, software developers, etc.) come together to exchange goods, services and information. Platforms bring a new dimension to more traditional models of firms selling their services online. Successful platforms make use of network effects to attract more users on several sides of the market: more consumers attract more suppliers and vice versa. They also leverage the data that they collect on user behaviour on the platform to reinforce their own position. Economies of scope in data collection and analysis give them an informational advantage over individual suppliers and consumers.

Policy makers on both sides of the Atlantic have turned their antennas to online businesses and started brainstorming on the possible need for regulatory approaches to address citizens' concerns. In the EU, the European Commission's Digital Single Market strategy (May 2015) announced a comprehensive assessment of the role of "platforms" in the economy with a focus on several types of consumer and producer concerns. For consumer it is often unclear for users how platforms collect, process and present information. Consumers may not be able to distinguish between organic and paid-for search results. Search results are often personalised. Price comparison websites do not explain their business model. Consumers do not know what data about their online activities are being collected and how they are being used. Users may be under the impression that the platform is the supplier, whereas the real counterparty is an individual. EU consumer rules apply to B2C contracts, not to C2C. When buying from a platform, consumers may face difficulties in identifying who is responsible in seeking redress. Supplier concerns include asymmetry in bargaining power between big platforms and SMEs, companies may not get access to the data collected through their transactions, some platforms act both as a marketplace and a retailer. This might lead to discrimination in listings between own and third party services, high fees/non transparent pricing (listing and referral fee), restrictions on pricing. Competition policy authorities have been paying attention to digital businesses for more than a decade now, ever since the Microsoft Windows case. However, competition authorities usually work on a case-by-case basis and look mainly at possible market dominance and distortions. While competition policy examines market positions, regulators may want to enquire into other issues such as data collection and use and the welfare implications that these may entail.

This report is a contribution to the economic assessment of platforms. The objective of this report is to complement the findings from stakeholders' replies to the public consultation on platforms with more objective analysis and, where possible, empirical evidence. This report is based on the findings and conclusions that can be drawn from existing economic research literature and evidence; it does not present any new evidence. However, it is not meant to provide an exhaustive economic literature review on platforms; it focuses only on a limited number of issues that may be relevant from a regulatory policy perspective. It focuses on potential market failures in digital platforms and examines to what extent existing regulatory tools and self-regulation in platforms

can address these failures, or whether there is a need for additional regulatory intervention.

This report is structured as follows. In Chapter 2 we explore the economics of platforms, taking a historical perspective that starts with network effects and competition policy concerns and ends in the central role of economies of scope in search and data analytics that facilitates the emergence of new types of firms – online market places and collaborative economy platforms – that complement traditional vertically integrated firms and retailers. Chapter 3 goes deeper into the search & matching role of platforms and examines possible biases that this may induce and what regulators could do about this. Chapter 4 goes into legal liabilities of platforms as intermediaries, both within the context of the e-Commerce Directive ad beyond. Within the ECD we explore liability for copyright-protected content. Beyond the ECD we examine platform's market-driven initiatives to improve self-regulation, the limits to market initiatives and possible areas where regulatory intervention might be considered. Chapter 5 focuses on the use of personal data in platforms. It presents an economic perspective on privacy and personal data protection as well as on data markets between firms. At the end we discuss how existing regulatory tools could be better used in this respect.

2. The economics of platforms

2.1. The history of platform economics: a competition issue

In its most generic form a "platform" is a market place where two or more distinct types of users (for instance buyers and sellers) can meet to exchange goods, services information, etc. That market may be an online digital market or an offline physical market. Offline platforms have existed for millennia as ordinary village markets where sellers and buyers exchange their wares under the supervision of the village chief (the platform operator) who may levy a tax for the use of the physical space that the village puts at their disposal. Other parties may operate and benefit from the village market platform, for instance street artists and pick-pockets.

The prime attraction of the village market is that it reduces transaction costs between distinct user groups. It brings many consumers and sellers together in a single place. That offers more variety of products to consumers and makes it easier to find the goods they are looking for. For producers, it brings many consumers together in a single place and time slot and that generates economies of scale in sales. There is a "chicken and egg" (Caillaud & Julien, 2003) issue: more buyers will attract more sellers to the market, and vice versa. This is called an indirect network effect: the market becomes more valuable for each user when more representatives of the other type are present. In an ordinary linear business model without network effects, the value of a business increases linearly with the number of clients. In a networked business, the value increases exponentially with the number of agents connected to the network. The task of the platform organizer – the village chief/ the platform operator – is to attract as many users on all sides. Indirect network effects may work differently according to the user group: pick-pockets will positively appreciate the presence of more buyers but the effect is likely to be negative in the other direction.

There may also be direct network effects within each group of users. Consumers often feel attracted by the presence of other consumers because if offers opportunities for social interaction and drawing benefits from each other's experience. For example on Amazon books, book buyers can benefit from the recommendation lists compiled on the basis of purchases by others. Suppliers may benefit from the presence of more suppliers because it increase the variety of goods available on the platform and thereby the attractiveness of the platform. However, to the extent that suppliers overlap in the range of products on offer, they may become price competitors and that may constitute a negative externality within the group of suppliers. A third party may intervene on the platform, for instance advertisers in ad-driven online businesses – Google AdWords is one of the most famous examples – that may generate negative externalities for another party, for instance consumers who are irritated by ads, but positive externalities for advertisers. The combination of all these positive and possible negative network externalities affects the economic welfare of the parties operating on the platform and, together with the welfare of the platform owner or operator, the overall social welfare effect of the platform.

Finding opportunities is an information issue: where do I find suitable partners for an exchange? Digital information technology triggered a dramatic reduction in online information costs. In the absence of the physical and visual matching possibilities in online markets, digital platforms have to invest in matching or search algorithms to facilitate matching between different types of users. For instance the general Google Search engine and specialized algorithms in other online platforms (Amazon, eBay, Facebook, Expedia, etc.).

Economists do not use the word "platforms" but prefer to talk about two-sided or multi-sided markets (MSM), depending on the number of distinct user groups. Gawer & Cusumano (2002) and Caillaud & Julien (2003) refer to 'intermediary markets' serving two distinct groups of customers rather than platforms. The expression 'MSMs' was first introduced by Rochet & Tirole (2003, 2006) and was used by Wright (2004) and

Armstrong (2006). Evans (2003) and Evans & Schmalensee (2007) use the expression 'two-sided platforms'. On the other hand, Parker & Van Alstyne (2000, 2005) were converging on 'two-sidedness' coming from network and information theory, and with Eisenmann were the first to talk about two-sided 'strategies' rather than 'markets' (Eisenmann et al., 2006). Rysman (2009) also use the expression 'two-sided strategies' to convey the idea that there are choices made by agents rather than an imposed endogenous industry structure.

Historically, economists began to pay attention to the phenomenon of MSM with the rise of online markets. The first thing that caught their attention in MSM is network effects. Network effects generate externalities: the user gets more (or less) than what he pays for. As a result, prices no longer correspond to actual benefits or costs. The price paid for access to the network no longer matches the marginal cost or marginal benefit of joining it. According to Rysman (2009) the MSM economics literature could be seen as a specific segment of the literature on network effects (Katz & Shapiro, 1985).

Network effects create an anomaly in the behaviour of MSM, compared to ordinary markets. In order to overcome the "chicken and egg" problem they may set prices below marginal cost or even negative prices for one type of users in order to attract more users of another type and make the market more attractive for both types. Caillaud & Jullien (2003) found that MSM operators can leverage these network effects in order to expand their market share. Access prices – access and transaction fees - can be manipulated in order to maximize the attractiveness of the platform for all the parties and help the platform operator to maximize his market share and revenue. Depending on the price elasticity of supply and demand, either suppliers or customers should be made to pay a fee for access to the MSM while the other side can be subsidized. This led to a variety of platform business models with fixed and variable (auction-based) pricing, cross-subsidisation for various parties in function of their measured behaviour and market power. Armstrong (2006), Rochet & Tirole (2003, 2006) and Parker & Van Alstyne (2006) are among the pioneering papers. Rochet & Tirole (2006) look at MSM from the point of view of non-neutrality of the pricing structure. In ordinary markets, the total price level determines the volume of activity. In markets with externalities, the split of the price between different sides of the market will affect the volume of activity. Together, these papers constitute the classic MSM economics literature. Many other researchers have added to this in recent years with further theoretical and some empirical contributions.

The combination of network effects and potentially predatory pricing behaviour in MSM drew the attention of competition economists and competition authorities because it may explain why some successful platforms manage to reach a very strong market position in a relatively short time. Network effects and economies of scale create a strong tendency towards market concentration around a few big firms. Moreover, strong network effects can be persistent and increase the risk of lock-in. The pricing models developed in the MSM economics (Armstrong (2006), Rochet & Tirole (2003, 2006) and Parker & Van Alstyne (2006) only reinforce the need for vigilance by competition authorities. It also explains why the subsequent development of economic research around MSM focused mainly on competition issues.

Traditional competition policy assumes that a welfare-maximizing competitive equilibrium exists as long as prices reflect social value. In that case, competition policy aims at alleviating the inefficiencies that are caused by market power and price distortions. This perspective is not necessarily valid anymore in online MSM markets. Pricing on two sides of the market may not reflect social value and pricing practices may hurt some users but benefit others. Still, the overall price structure may well be welfare-enhancing. When competition authorities consider an intervention in a MSM they should be aware that intervention on one side will affect the other side. A case-by-case overall analysis that includes all sides of the market is required.

High market concentration because of indirect network effects is not an exclusive phenomenon in online markets. The existence of one large marketplace may be an efficient outcome if it helps to reduce search costs for consumers for instance, which would not be the case when a large number of small marketplaces would exist. Competition between several firms is almost always beneficial in traditional markets - as long as the market is not characterized by natural monopoly conditions. This general insight does not necessarily hold for MSM. Even in the absence of scale economies considerations, the existence of multiple platforms may not be efficient because it reduces indirect network effects (Caillaud and Jullien, 2003). A monopoly platform can be efficient because network effects are maximized when all agents manage to coordinate over a single platform (Jullien, 2005; Weyl, 2012).

Three factors may promote competition in MSM: capacity constraints (the risk of platform overload); heterogeneous preferences among users (the potential for platform differentiation); and multi-homing possibilities (the possibility to participate in several platforms at the same time). Physical capacity is restricted in offline MSM such as shopping centres and nightclubs, for instance. While physical limitations are irrelevant in online MSM, capacity constraints may come in other forms. Advertising space, for example, is often restricted since too much advertising is perceived as a nuisance by users (Bagwell, 2007). Screen size, especially on mobile devices, may reduce advertising space and the variety of products that can be meaningfully displayed. If user groups are very heterogeneous, search costs may go up for individual users and targeted advertising may become more difficult. The higher the degree of heterogeneity among potential users and the easier it is for platforms to differentiate, the more diverse platforms will emerge and the lower will be the level of concentration, a well-known result in economics (Dixit and Stiglitz, 1977). The ease of multi-homing depends on switching costs between platforms and whether usage-based variable charges or fixed access tariffs are charged on the platform. In some sectors switching costs are low, for example in online travel services, and the degree of monopolisation is low. In social networks by contrast, switching costs may be higher because of strong direct network effects and the effort needed to coordinate user groups. Multi-homing options make it difficult for MSM to lock-in users and consolidate their market dominance. Multi-homing may be possible for one type of MSM users but not for all. For example, in digital media distribution, producers multi-home and sell their products through several platforms: Apple iTunes, Google Play Store, Amazon, etc. However, consumers are often bound to a single platform because of the high cost of acquiring a device that is compatible with one of these platforms. Switching costs for consumer remain high in these cases. A similar situation occurs with game consoles. An important factor in competition between data-driven platforms is user data portability: users can take their investment in data out of one platform and transfer them to another. The transferability of telephone numbers between telecoms platforms is a good example. However, portability of telephone numbers is easy; it requires the transfer of one number only that can clearly be attributed to one user. With more complex datasets in platforms, it is not clear how portability can be made to work. How to define "my data" in Facebook and how to make them transferable to another social network?

Many of the most successful online platforms offer "free" services to users. They thrive on ad-driven business models that make only one side pay (the advertiser) and offer zero-priced services to suppliers and consumers. They exchange ubiquitous information in return for scarce attention (for the advertiser) and personal data (for the platform operator). Google Search is the most well-known and successful example. The absence of a price does not mean the absence of a market; free services may compete with paid services in the same market. For example YouTube competes to some extent with paid music and video. Free services may raise barriers to entry for other services and affect competition. A better understanding of this type of markets requires an expansion of the concept of competition to non-traditional features, including zero pricing, transaction costs, quality of services, etc. (Jullien, 2015).

Internal platform regulation may also affect competition in the market. Platforms are to some extent self-regulating markets (Boudreau & Hagiu, 2010). They have an interest in improving the interactions between users in order to make the platform more attractive. For instance they may restrict competition within the platform (entry fees, licenses); they may regulate prices, monitor user behaviour and collect feedback from users, and facilitate the enforcement of contracts between users (arbitration, reimbursement policy). Platforms may have good reasons to impose regulation, for instance to avoid free-riding on information (platform used as showroom or for feedback purposes only) and expropriation of platform and users investments. However, these self-regulatory interventions may distort competition. Competition authorities should be careful in over-ruling these regulations however because restrictions on one side of the market will affect the other sides as well. For instance, some platforms apply price exclusivity clauses in contracts with their suppliers (for example Booking.com): suppliers should not sell at lower prices elsewhere. Price exclusivity reduces competition and may therefore be perceived as bad. However, lifting the price exclusivity clause may increase prices.

Evans (2015) demonstrates that there is a lot of churn in the top platform rankings and that the risk of entrenched monopolies is very limited. For example, MySpace was the leading social media platform in the mid-2000s but has now almost disappeared. Nokia/Symbian was the leading technology platform for mobile phones but has now been replaced by a de facto oligopoly between Android, apple iOS and Windows. Windows' dominant position in the operating systems market is under increasing pressure from Apple iOS and other operating systems. Google AdWords' strong position in the online advertising market is under pressure from Facebook advertising. New platforms can emerge outside the existing dominant platform (Google Android versus Nokia Symbian) or within platforms. Platform "envelopment" (Gawer, 2008) may occur inside a dominant platform. For example, a popular game in a mobile phone platform can turn itself into a multi-sided market, not only between users and plug-in developers but also for advertising. Some popular games are featuring ads for new and less popular games. New entrants pay the incumbent popular game to advertise on that platform and thereby leverage their own popularity. Incumbents may want to be careful to grant that advertising space only to complementary products, not to substitutes. These examples lend support to Glenn Wright's (2013) argument that Schumpeterian technological competition between platforms is able to undermine even strongly entrenched market positions. Oligopolistic competition driven by technology may therefore we welfare enhancing because it allow only temporary profit maximisation and stimulates new entrants to develop new and better technologies. Competition is much more important at the technology edge of platforms that at the pricing end. The static MSM pricing models discussed above cannot explain this phenomenon.

2.2. A wider view: platforms as an extension of the classic firm

Readers will have noted in the preceding sections the interchangeable use of "platforms" and "MSM". But are they really equivalent concepts? Economists prefer to use the label "MSM". Rochet & Tirole (2006) noted that the emerging platforms literature "had much of a 'you know a MSM when you see it' flavour". Almost a decade later that easy-going approach has disappeared and there is no consensus among economists on the definition of MSM (Li, 2015). Existing definitions suffer from excessively narrow specificity, over-inclusiveness, or being too vague to be of use (Hagiu & Wright, 2015b).

In early economic models of intermediary markets or MSM, Rochet & Tirole (2003) and Caillaud & Jullien (2003) indirect network effects are assumed to exist on both sides and in both directions. They are fundamental in the operations of these markets. The role of the platform operator or intermediary is to internalise these externalities that are generated by the fact that the decisions of each set of agents affects the outcomes of the other set of agents. In addition Rochet & Tirole (2003) require that (a) the two sides

cannot coordinate and become a unified interest, and (b) the amount charged by the platform on one side cannot pass through to another side.

Three years later in their second contribution Rochet & Tirole (2006, p.657) considered what they termed the 'cross-group externalities or indirect network effects definition of MSM' as 'under-inclusive' because it would exclude MSM with weak or non-existent indirect effects. They propose that the key characteristic of an MSM is that the price structure is non-neutral: "A market is two-sided if the platform can affect the volume of transactions by charging more to one side of the market and reducing the price paid by the other side by an equal amount. In other words, the price structure matters, and platforms must design it so as to bring both sides on board" (Rochet & Tirole, 2006, p.664-665). In this much wider definition of MSM it is only the price structure that matters since indirect network externality as a necessary condition would make MSMs under-inclusive.

Rysman (2009) argues that the generality of the Rochet & Tirole (2006) definition should not necessarily be a problem. The question is what we can learn from this approach to MSM. Two-sidedness may exist in many markets but the externalities are not always quantitatively important. Rysman (2009) gives the example of a local grocery store that buys food products from a farmer. Armstrong (2006) classifies the grocery store as a MSM while Rysman (2009) sees it as a one-sided market with no indirect network effects. Whether or not the farmer is paid a price in function of the number of consumers on the other side of the market is an empirical question. It looks like many classification debates between single-sided and multi-sided markets are actually empirical questions on the relative strength of the network effects and externalities. We can then define a single-sided market as a market with no or very weak indirect network effects between the different sides of the platform and a "true" MSM as a market with stronger indirect network effects. In other words, the definition of an MSM becomes an empirical question. This takes us far away from the "you know it when you see it" approach.

Armstrong (2006), Evans (2003b), Evans & Schmalensee (2007) and Filistrucchi et al. (2013) have further relaxed this definition. Where Rochet & Tirole (2006) require two-way indirect network effects, they consider that the existence of a one-way indirect network effects for at least one group of users is a sufficient condition for a MSM. According to Evans (2003b) the conditions for a two-sided platform are that (a) there are distinct groups of customers, (b) a member of one group benefits from having his demand coordinated with one or more members of another group, and (c) an intermediary can facilitate that coordination more efficiently than bi-lateral relationships between the members of the group. Evans & Schmalensee (2007) later add that for condition (b) it is sufficient that one side is attracted by the increasing size of the other side.

Filistrucchi et al. (2013) subscribe to this view. For example when discussing media platforms they recognize that viewers generally do not like TV advertising (Wilbur 2008) and conclude that 'it is not necessary for the existence of a MSM that two indirect network effects be present. One suffices' (Filistrucchi et al., 2013, p. 38). They characterise the TV broadcasting market as a MSM with one positive (supply of content) and one negative indirect network effect (advertising). According to Li (2015) it is crucial for advertising-supported media to qualify as MSM. Media platforms would not qualify as two-sided if two-way indirect effects are needed. Armstrong (2006) further distinguishes between 'membership' (access) and 'transaction' (usage) types of MSM, where originally Rochet & Tirole (2003) considered only transaction fees. The confusion further increases with Li (2015) who casts doubt over whether advertising-supported media should be considered as an example of MSM and Lucchetta (2015) who claims that the Google Search engine is not a MSM. Filistrucchi et al. (2013, 2014) suggest a pragmatic solution whereby two-sidedness is considered to be an empirical matter to be ascertained case by case.

Some authors proposed more fine-grained typologies of MSM[2]. Evans (2003b) and by Evans & Schmalensee (2007) propose an MSM classification that distinguishes three types of MSM: market makers, audience makers, and demand coordinators. Market-makers bring together two distinct groups that are interested to trade. They increase the likelihood of a match and reduce search costs. Audience-makers match advertisers to audiences. Software platforms, operating systems, and payment systems are defined residually as demand-coordinators. They neither sell a transaction nor a 'message' but coordinate demand and thereby avoid duplication costs. Filistrucchi et al (2013; 2014) distinguish between transaction and non-transaction MSM; some sides in an MSM may participate without a transaction. Membership externalities in non-transaction markets arise from simply joining the platform (placing an ad in a newspaper, holding a payment card, having a point-of-sale terminal or attending an auction). Usage externalities arise from using the platform (for example, paying or accepting payment with a card, selling or buying a product at an auction).

Recently, the definition pendulum has started to swing again in the other direction towards more narrow definitions. Hagiu & Wright (2015b) argue that this definition of MSM is over-exclusive and far too generic to be operationally useful. Any corner grocery story would fit into this definition because it offers a platform that brings a group of suppliers and consumers together to transact; they generate indirect cross-group network effects (the more consumers, the more suppliers will want to deliver to the store – and vice versa) and the price structure creates externalities (the allocation of access prices between sellers and buyers will affect the turnover of the store). They narrow the definition of MSM and add two conditions on top of indirect network effects and pricing externalities: (a) direct interactions between sellers and buyers or between two or more distinct sides and (b) each side is "affiliated" with the platform and makes specific investments that binds them to the platform and makes it costly to leave (non-zero entry and exit costs). According to these authors, direct interactions between multiple sides set MSPs apart from resellers (like grocery stores for example) and fully vertically integrated firms. This narrow definition would exclude some important online service providers from the category of platforms or MSM. For example, Netflix would not classify as a media MSM but merely as a retailer of films because there is no direct interaction between buyers and sellers and no affiliation costs on either side. Similarly, only the Market Place part of Amazon would classify as an MSM because buyers and sellers have some direct interaction; the Amazon resale book store would be a simple online retailer.

Perhaps the most important contribution of Hagiu & Wright (2015) is that they build a bridge between the fairly young MSM theory and the older and much more widely established theory of the firm and vertical integration. The extent of vertical integration in that supply chain goes back to Coase's (1937) and Williamson (1976) and the central role that information or transaction costs play in a firm's choice to "make" or to "buy" an input. The modern vertical integration literature has developed these arguments in great detail under various labels including agency, contract and property rights theory. All these theories take as a starting point that information is costly and therefor asymmetrically distributed and incomplete. Complete information would be infinitely

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[2] Variable degrees of vertical integration and asymmetries between the parties on a platform make it more complex to apply the concepts of B2B, B2C and C2C in online platforms. B2B is often understood as a supply chain whereby seller and end user /buyer are formal companies and not individuals. In MSM some parts of the relationship can be B2B, others B2C and C2C. For example, in Google Search, the end users of search results are individuals and companies (both B2B and B2C). Advertisers on Search are companies that deal with a Google AdWords (B2B). Sellers on Amazon Marketplace can be individuals and companies; sellers on Amazon as a re-seller will be companies only. Sellers on AirBnB may be individuals or companies. Part of the commercial transaction (payments) runs through AirBnB (B2B) while content is delivered to end users (B2C).

costly. Transaction contracts are therefore necessarily incomplete and leave a degree of residual uncertainty and potential moral hazard and adverse selection in contractual relationships between different actors in the supply chain – in the case of MSM between different sides of the market. For a modern synthesis of theories of the firm, see Gibbons (2005). Hagiu & Wright (2015a, 2015b) formalise strategic choices and trade-offs that other authors had earlier considered in non-formalised ways (Evans et al., 2006; Gawer & Cusumano, 2008; Gawer & Henderson, 2007; Rysman, 2009).

Hagiu & Wright (2015a) move beyond the generic MSM model and distinguish between different types of online markets (see figure below). They model the choice between a platform that offers a market place (M) where suppliers and consumers can meet and a platform that acts as a reseller (R). In the former case, control rights (over pricing, promotion campaign, sales conditions, etc.) remain with the supplier. In the latter case the platform buys the products from the supplier and acquires control rights. The authors argue that the choice between these modes is determined by the relative information advantages of the seller and the intermediary[3]. They identify three factors that drive the shift between modes. First, positive spill-over effects across products, brands and different types of buyers favour the R mode. The M mode would lead to over-investment in product- and brand-specific activities without spill-over benefits. Second, relative marginal cost advantages between sellers and intermediaries affect the choice. In R mode, intermediaries may have a cost advantage in superstar products that are sold on a large scale; this favours business models with high fixed & low marginal costs. In M mode, suppliers may have an advantage in long-tail niche market products with lower turnover but higher marginal costs. Third, positive network effects across market sides (between buyers and sellers, in one or both directions) favour R business models. This explains why some successful platforms are actually not platforms in the sense of a market place: the iTunes and Google Play stores, the Netflix film store and the Amazon book store are resellers that allow no direct interaction between buyers and sellers. Some platforms such as Amazon are hybrids that sell some products in M mode and others in R mode. The first and third drivers are essentially informational advantages generated by externalities and network effects; only the second driver is a more traditional cost advantage factor. Hence the importance of data collection and analytics in platforms to maximize the benefits derived from the first and third driver.

The authors provide some empirical evidence in support of this view. For instance data collected from the Amazon website show that Amazon operates predominantly in R-mode in books because it has privileged information about the preferences of buyers that makes demand and inventory management more predictable, except for the long tail in book sales where demand is much harder to predict and the M-mode is more prevalent. Amazon works in M-mode for electronic goods because the variety of products and variance in consumer preferences is much higher and more difficult to predict. That undermines Amazon's marginal cost advantages in logistics and inventory management.

Differences in the role of platforms as intermediaries or resellers may have implications for their liability towards consumers. In a subsequent paper, Hagiu & Wright (2015b) expand this model with two additional typologies: the vertically integrated firm (VI) where supply is completely integrated into the intermediary platform and the input supplier (IS) where supply is totally disconnected from the intermediary platform[4]. When professional firms vertically integrate they control the provision of the services and

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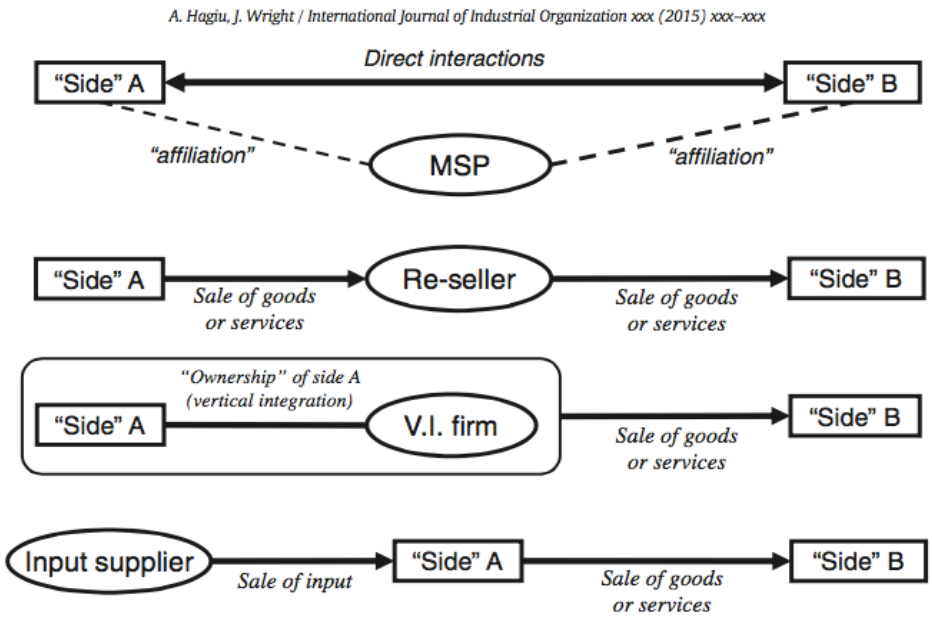
[3] The label "intermediary" is used in a somewhat different way in the E-commerce directive where it refers to the liability and duty of care of online intermediaries that host, cach or transit digital content, mostly in connection with illegal content (violation of copyright and trademarks mainly). An online platform hosts information on digital or physical content. Here we are referring to liabilities to go beyond intellectual property rights and may include consumer protection legislation, product liability, etc.

[4] For Rysman (2009), the R, VI and IS modes are single-sided markets, not MSM or special cases of a MSM.

are directly responsible for them; in MSM mode (i.e., they consider examples such as Uber, Lyft, and Elance–oDesk.com) the suppliers of services retain responsibility for and residual control rights over the services. The fundamental trade-off in this strategic choice is between the coordination benefits that arise in a VI model and the benefits of motivating professionals' effort and getting professionals to adapt their decisions to their private information that arise in a MSM model. In the VI mode there is a possibility for professional efforts 'moral hazard'; on the other hand, in the MPS mode there can be information-related moral hazard by online platforms that can extract insights from the aggregate data generated by the interactions between contractors and customers on their sites—insights that are not known to any individual contractor. Apple hardware and Amazon Kindle are examples of VI: Apple and Amazon design and sells their own hardware. Apple iTunes however allows external suppliers to contribute software and content to the Apple platform. Microsoft Windows is an example of an IS structure: any hardware manufacturer can produce Windows-compatible hardware without any formal affiliation with Microsoft. Again, the degree of platform (dis)integration in VI and IS extension of the M/R model is driven by information asymmetries between different actors in the supply chain.

Figure 1: MSPs vs. alternative business models



Source: Hagiu & Wright (2015)

The approach by Hagiu & Wright (2015) allows us to finally answer the question: What is a platform and what is an MSM, and is there a difference between these two concepts? Their approach to platforms reflects rather well what we observe in online markets and enables us to categorize different types of platforms because they operate under different conditions. It also takes us out of the unproductive academic debate on what defines a MSM and allows for different types of MSM operating under different conditions and definitions. All these types can be put under the broad banner of "platforms" because different types of users get together in these platforms. At the same time, the variation in business models has different implications for different types of users on that platform. "Platform" is a broad label for several distinct types of MSM. The common element is that different types of users (sellers, buyers, advertisers, etc.) come together to reduce transaction costs. The variable element across these types of MSM is the relative importance of indirect network effects, cross-product and brand spill-overs and classic cost factors.

2.3. Conclusions

In the universe of online firms some are single-sided suppliers, either individual producers or vertically integrated firms, who produce their own products or services and sell them directly to clients on the internet. They are clearly outside the world of platforms or MSM. Others are retailers who buy products from other producers and sell them to a wide range of customers. If they experience indirect network effects then they classify as MSM according to the original Caillaud-Jullien (2003) definition of MSM. However, Rochet-Tirole (2006) considered this definition to be over-inclusive precisely because any firm could be included in this definition. They propose a narrower definition where the price structure and not only the price level matters. Non-conventional price structures that subsidize one side of the market and overcharge another side, depending on the price elasticities on each side, can maximize traffic on the platform. To the extent that firms and retailers would be able to practices such pricing structure they might fall within this narrow definition of platforms. Both these definitions have generated debates about the competition policy implications of online platforms.

Hagiu-Wright (2014) propose a further narrowing of the MSM definition to a "market place" where users invest a sunk cost in "affiliation" to the platform and users on different sides of the market can directly communicate with each other. At the same time they introduce a vertical integration dimension and distinguish between "market places" and retailers or re-sellers. The latter take control of the transaction while market places let buyers and sellers interact more freely. The vertically integrated firm constitutes a separate group in the Hagiu-Wright categorisation because the platform operator "owns" the supplier. Retailers and vertically integrated firms fall outside the scope of an MSM in their definition while Caillaud-Jullien would include them. Rochet-Tirole would only include retailers in the MSM definition because, to the extent that they are market-makers, they can tweak the pricing structure of the inputs that they buy.

This short presentation of the history of economic thinking on platforms shows that, even at theoretical level, platforms are a flexible concept, depending on the definition. The empirical assessment of the magnitude of indirect network effects and the ability to manipulate the pricing structure will play a role in the classification of real-life cases. In practice, this implies that the classification of online service providers into different types of platforms can only be done on a case-by-case basis, combining theoretical and empirical decision factors.

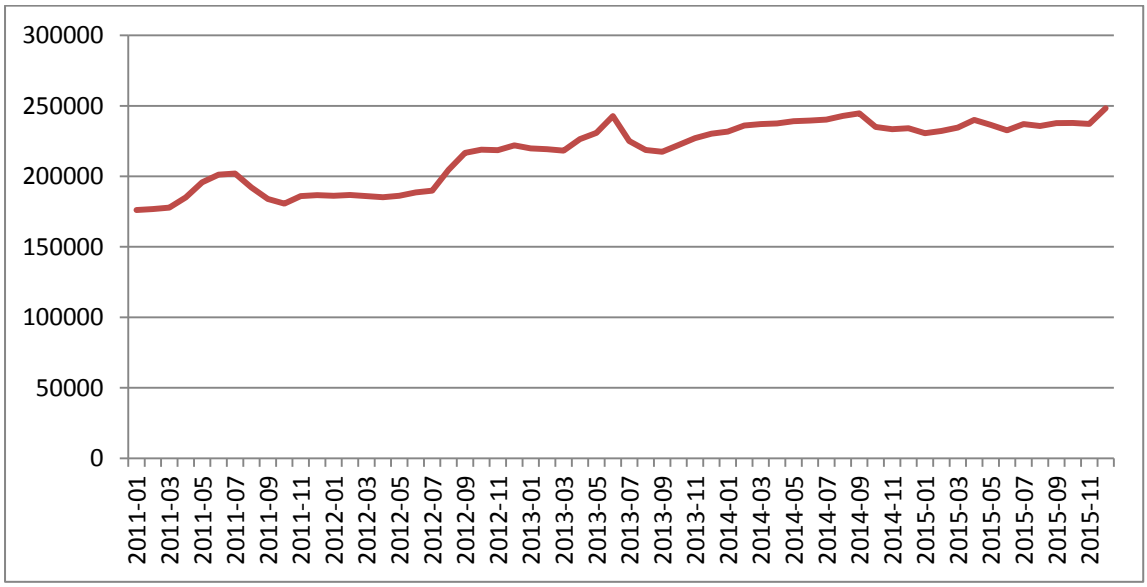
Box 1: How important are online platforms@

Since there is no consensus definition of platforms it is not possible to compile a list of platforms or measure their relative importance in the online economy in a precise way. Still, we can try to construct some measures that give us at least a crude indication of their importance.

We start from a list of 178 large and fast-growing online platforms compiled by Evans & Gawer (2016). They identify a number of two- or multi-sided online platforms based on market capitalisation data as a selection criterion. We complement this list with internet activity statistics on these platforms (page view data from Amazon Alexa) and construct a dynamic picture of activity over the last 5 years. Page views are expressed as page views per million worldwide views collected through the Alexa sample survey. Many platforms are hybrids that combine website-based and app-based access to their services. There are no publicly available measures of app-based activity (only downloads). It is likely that app-based access has grown faster than web access over the past years. Page view data will therefore underestimate real growth in these services.

We find that the share of these 178 platforms in total web-based traffic has substantially increased over the last 5 years, from about 175k to 250k page views per million worldwide views, an increase by more than 40%. This implies that these 18 platforms accounted for about 25% of all internet traffic by the end of 2015. It shows that these platforms represent indeed a large and growing part of total web-based activity.

Figure 3: Internet traffic on major platforms (2011-2015)



Source: Evans & Gawer (2016) for a list of 176 platforms; Amazon Alexa for internet traffic data.

Note: Vertical axis = worldwide page views per million (Alexa) on 178 platforms.

3. The core role of platforms: search & matching

The discussion in the previous section on the economics of platforms gives us a better understanding of some of the mechanisms at work in platforms. Pricing and network effects drive the volume of transactions on platforms. However, another fundamental characteristic of online platforms is their capability to match a very large number of users in a market in order to facilitate an exchange. Platforms help users of different sides of the market (sellers, buyers, social media users, advertisers, software developers, etc.) to find what they are looking for. The more efficient the platform is in matching users, the more users will be attracted to the platform. Search rankings and price auctions are the main tools to facilitate online matching.

Matching is also a key feature in traditional offline platforms such as village markets and supermarkets. Their matching capabilities are limited to providing a central physical location that reduces search costs for users who want to find each other, possibly enhanced by some other search tools such as in-site publicity and an ordered positioning ("ranking") of products in physical space. Physical proximity reduces search costs and boosts network effects but still leaves considerable search costs to the users. Search costs can be further reduced by means of search rankings. In a physical market, market stalls are ordered by type of product for instance in order to reduce search costs. The local of products in large supermarkets is done in such a way as to enhance visibility and "findability" but also to draw attention to the products that the supermarket wants to promote. Traditional newspapers offer a curated selection of new items ordered and ranked by themes and relevance but also to boost sales of the newspaper.

Online platforms do not only provide a (virtual) location for market exchanges. Contrary to village markets they actively collect information on suppliers' products and consumers' preferences and use matching algorithms to match these in an efficient way in order to reduce search costs. The more information they have on supply and demand characteristics, the better the search ranking and the lower the search costs for users. Search rankings are a universal phenomenon on the internet, not limited to a few general search engines like Google, Bing and Yahoo. Many websites offer specialised and more vertically restrained search options. For instance, Amazon provides within-site search results on books, electronics and other consumer goods. Online stores can carry many more products than offline stores can ever manage. The worldwide web contains billions of web pages; Apple iTunes contains millions of songs and the Amazon book store carries millions of book titles, far more than the largest offline music and book stores can handle. The sheer volume of information available on the internet creates search costs. Search engines try to bridge the unavoidable information asymmetry by filtering the information found on the internet in response to a user query and presenting the outcome as a search ranking.

Search costs are deadweight losses for society: nobody gains from high search costs, neither the supplier nor the consumer. Reducing search costs increases potential welfare gains for society, including for the platform operator because it will attract more activity to the platform. Reducing search costs is one of the main drivers of competition between online platforms. While all users gain from more efficient matching and lower search costs, the distribution of these gains depends on the search ranking. Search rankings can be biased and lead to suboptimal results for one or more types of users.

Perfect matching between different users on a platform requires very low information costs and close to perfect information matching algorithms. Fradkin (2014) predicts that "As the marketplace designer's knowledge about buyer and seller preferences approaches the full information benchmark, outcomes approach their frictionless benchmark. The on- going reduction in the costs of storing and analyzing data, commonly referred to as the "Big Data" revolution, will likely have a profound impact on

platforms like Airbnb because more and better data can improve the platform's estimates of agent preferences".

Despite their strong data collection capabilities, online platform search functions often remain inefficient and maintain considerable friction in the market. Digital matching should aggregate and use information efficiently while at the same time minimise the search and deliberation efforts to reduce transaction costs compared to other alternative channels and make it convenient for the users to transact on the platforms (Einav et al., 2015). In this optimisation problem heterogeneity in products offered and user preferences is a major challenge. Empirical research emphasizes that online markets are inherently frictional (Fradkin, 2014; Horton, 2014). Recent work in this area has focused on the microstructure of specific marketplaces, estimating search inefficiencies (Fradkin, 2014; Cullen & Farronato, 2015), heterogeneity in the matching process and problems of congestion (Horton, 2014), the consequences of search frictions and platform design for price competition (Dinerstein et al., 2014), the differences between distinct types of pricing mechanisms (Einav et al., 2013). Pricing mechanisms can sometimes be used to deal with the trade-off between transaction costs and efficient use of information to maximise matching probabilities. There is a choice between centralised and decentralised (auction-based) price setting (Einav et al., 2015). For some time auctions seemed the optimal way for maximising revenues while maintaining incentives for buyers. Yet, they may be cumbersome and time-consuming and have gradually been abandoned in some applications (eBay) but not in others (ad-auctioning on Google AdWords). Some authors have observed an apparent trend away from decentralised auction mechanisms towards centralised price setting, as witnessed by the decline in the number of digital platforms that use auction mechanisms (Einav et al., 2013).

Data collection and analytics put platform operators in an advantageous position compared to individual platform users who have less information than the platform. This affects the structure of the supply chain (Hagiu & Wright, 2015a, 2015b) and puts platforms in a dominant position. These advantages do not only consist of raw data collection but more importantly of the analytics that can be applied to the raw data and the value of the insights that this analysis represents. Economies of scope in data collection & analysis play a key role here (see next chapter). The data collected may be used selectively by the platform operator to modify the behaviour of one or more sides of the platform. Intrusiveness, bias in search rankings and manipulation of user behaviour all point to welfare distribution issues. Many of the complaints voiced by platform users in the public consultations on platform behaviour revolve around these distributional issues that are often perceived as unfair (European Commission, 2016). While traditional economics may have a hard time saying something meaningful about welfare distribution, society cares not only about the overall increase in welfare but also its distribution between different user groups.

Platforms are profit-maximizing private firms and just like any other firm they are free to pursue their own interests. In this section we discuss two types of bias in search: inherent bias driven by "superstar economics" and more commercially motivated bias.

3.1. Superstar economics

Search rankings suffer from an inherent problem called "superstar economics" (Rosen, 1981). Rankings have a top and a tail end. Top-ranked products are called superstars. Consumers look at a ranking of products and have a tendency to prefer higher-ranked products. They try to reduce search costs by looking only at higher-ranked products. This may create a lock-in effect: popular products become more popular. There is empirical evidence that a higher position in the ranking leads to higher sales. However, search rankings are endogenous and the direction of causality is not clear: Does a higher ranking increase sales or do more frequently sold items rank higher? Whichever way the causality works, rankings may create a lock-in effect: popular products become

more popular. Rankings are not independent but endogenous to search costs. Many long tail products in stores that carry millions of items probably sell no more than a few times. An analysis of online music sales data in European countries showed that out of millions of songs available less than a hundred thousand registered more than 1 sale (Duch-Brown & Martens, 2013). Digital online stores can afford to keep these rarely sold products in their database, though not necessarily in a physical stock. Offline stores cannot afford the storage costs for such unlikely sales.

An important question is to what extent digitization and online search engines have favoured superstars versus long tail sales. Building on the contribution of Johnson and Myatt (2006), Bar-Isaac et al. (2012) address the relationship between search costs and sales concentration. The authors interpret the diffusion of search engines as a fall in search costs. They conclude that long-tail and superstar effects arise simultaneously, at the expense of the "middle" group of products. This increases the skewedness of the sales distribution though not necessarily the ordinal ranking of products in a popularity-based ranking. Lower search costs may also bring in more searchers and consumers. That may increase total demand but also upset the relatively popularity of products and thus their rankings.

Moraga-Gonzalez et al (2013) show that a decline in search costs can affect the ranking itself. With random searches, high search costs reduce the number of places where consumers search. This reduced search range gives stores higher monopoly power and leads to higher prices. When search costs fall, for instance because of the shift to online shops and search engines, the locational monopoly of stores weakens and prices should in principle go down. However, when consumers search in a more directed way for specific product characteristics (with prices known), lower search costs may increase prices again because the price elasticity of consumer demand decreases. On the other hand, suppliers know that lowering prices today will increase sales and push them up the sales ranking, thereby making sales more likely tomorrow. Lower search costs may also bring in more searchers and change the composition of demand at the extensive margin and upsetting the relatively popularity of products and thus their rankings. In conclusion, the interaction between search costs, search rankings and sales and prices is theoretically ambiguous and requires empirical research. Platforms and search engine operators will have their own business models and incentives and will constantly test alternative commercial strategies and product rankings in order to maximize their own benefits. To what extent this benefits suppliers and consumers remains an open question that can only be adjudicated on a case by case basis.

3.2. Search neutrality and bias

Search rankings may not necessarily reflect user preferences. Platforms operate according to different types of business models that may be based on sales margins (for retailers), commissions on sales (for market places) or on advertising revenue (pure information matchmakers with no financial transactions). Platforms need to offer search facilities to enable users to find the content they are looking for. The incentives embedded in the business models may affect search rankings and drive a wedge between user preferences and the financial interests of platform.

General search engines such as Google Search, Bing and Yahoo that raise revenue from advertising have argued that they separate user-driven organic search results and revenue-driven paid-for ads. The latter are driven by the commercial interests of the advertisers and Google. Possible conflicts of interests and biased organic search results might occur when the organic ranking would include Google's own products. In case of Google, a dominant search engine, this constitutes a case for competition authorities. The on-going Google Search investigation by the European Commission is an example. Some authors have argued that there might be interference between organic and

sponsored ad search results (Rieder & Sire, 2013). However, so far there is no empirical evidence to support this claim.

The vast majority of online platforms are not general search engines; they offer specific vertical search only. They have no organic search results and are purely commercial operations with business models that may be based on sales margins (for retailers), commissions on sales (for market places) or on advertising revenue. The incentives embedded in these business models are likely to affect search rankings and drive a wedge between user preferences and the commercial interests of the platform. For example, Booking and Expedia take commissions on hotel room sales for third parties. The Apple iOS and Google Android apps stores offer free but also paid-for apps and take a commission on the latter. Price comparison engines thrive on sponsored price searches. Amazon combines a mixture of retailer and market place roles in books, electronics and many other consumer products. Price is not the only characteristic that consumers are interested in when buying online.

With a wide range of relevant product characteristics, search rankings necessarily depend on the weights given to these characteristics. Search engine weights are likely to differ from those of the individual user. The situation is comparable to traditional offline supermarkets that position products in a way that attracts consumer attention to specific products that they prefer to promote at the expense of others. If consumers know exactly what they want to buy (directed search) these promotion campaigns may have little effect. The search engine is only a tool to steer them as directly as possible to that product. Search rankings, including ads, may have little impact on consumer choice in that case. However, these implicit search rankings may have a stronger effect on more randomly searching consumers. The fact that platforms tweak their search rankings and drive a wedge between consumer preferences and their own commercial interests is not surprising and should not necessarily trigger a regulator's intervention – unless it would violate consumer protection rules.

The potential conflict of interest between search engine operators and users has triggered considerable debate on how the ideal search engine would operate. Some authors have proposed the term "search neutrality", an extension of the concept of "net neutrality". Grimmelmann (2012) expresses doubts about its feasibility. Grimmelman (2014) takes a more comprehensive view and discusses two fundamental and opposing approaches to search. The "conduit" theory sees search engines as a passive intermediary that makes an "objective" selection of relevant search results in response to a user's search query. The appeal for "search neutrality" and "accuracy and objectivity" in search can be situated in that context. The "editor" theory sees search as a subjectively curated ranking of results in response to a query, with the search engine as an active editor. The editor view implies that there is no such thing as search neutrality because any ranking represents the search engine's view of what is best. Grimmelmann compares several statements from senior Google staff that show that they also hesitate between the editor and conduit view. He reformulates these theories in terms of freedom of speech: the conduit view lets websites speak and the editor view lets the search engine speak. He argues that both theories misrepresent what a search engine can or should do. Search results are necessarily a combination of objective conduit and subjective editing. The ideal search engine – from a consumer point of view – would be a "trusted advisor". It should not mislead the consumer and present results that match his preferences. A search engine should fulfil that fiduciary role towards the user by "not letting its own conflicts of interest shape the results; it should not deliberately return results it knows not to be relevant; it must not misuse the search queries that is collects and must not conceal important results about how it generates results" (Grimmelmann, 2014). In other words, he reformulates the concept of search neutrality from the perspective of the consumer. Finally, he notes that a problem with search rankings may be that they are insufficiently personalised and cater to the average consumer only. Personalized rankings require access to more personal information,

beyond the historical record of previous queries. This creates a trade-off between privacy and search efficiency.

The "advisory theory" of search rankings is put to an empirical test by Ursu (2015). Using Expedia hotel booking data he confirms the existence of a conflict of interest between the platform operator and users. First, he finds that Expedia's subjective or profit maximizing "editor" role is constrained by consumer expectations about its objective "conduit" role to reflect relevant rankings. The number of clicks on higher-ranked hotels is higher but the number of actual purchases is constant across positions if hotels are ranked randomly. Consumers' perceived utility and willingness to buy does not change across a random ranking. Higher ranking in a random order affects clicks but not purchases and revenue for Expedia. A higher ranking only leads to a higher conversion rate (and revenue for Expedia) if rank position is related to better product characteristics. Expedia has an incentive to produce a relevant ranking that increases consumer utility and their willingness to purchase higher-ranked hotels. Second, he finds that ranking bias still drives a wedge between consumer utility and a website's profits. Running ranking simulations Ursu (2015) concludes that the average consumer would gain US$57 from an improved ranking, through a combination of lower search costs and better hotel rooms (half a star and half a review point more). However, this would decrease the average room price by 14 US$ and reduce Expedia's revenues. Compared to the ideal ranking for consumers, Expedia's actual rankings display hotels that are too expensive, with too few stars and review scores.

Chen et al (2015) come to similar conclusions about lack of transparency in their empirical investigation of pricing in the Uber taxi hailing app. Uber sets prices by means of a "surge pricing" algorithm. They find that it does not produce fair prices for customers and drivers. Customers placed at very short distances from each other can receive very different price offers for the same ride. A study of Airbnb (Fradkin, 2014) simulated different scenarios with interventions that could maximise matching and were all based on hypothetical changes in the use of information through algorithms.

Can bias in search be excluded? Supermarkets place products in ways that maximize supermarket revenue. Newspaper editors select articles that maximize sales. Price discrimination strategies in all markets are geared towards transferring consumer surplus to the seller and maximizing profits at the expense of consumer welfare. We accept all these commercial strategies in offline markets that direct consumers to products that supermarkets prefer to sell at the expense of other products. We seem to be critical of these practices in online markets however. Some of these online commercial practices might fall under the EU Unfair Commercial Practices Directive that could put constraints on the pursuit of the profit motive by online platforms and search engines.

3.3. Search and market access for firms

Firms or online suppliers face the same matching problem as consumers: how to find a matching party that is interesting in buying their products and services – or in the case of advertisers, watching their ad? Platforms matching algorithms that know more about users than individual firms do can be very helpful to achieve a match. Firms have two channels to find buyers for their products: the more passive search rankings channel where potential buyers can discover the product and the more active advertising channel whereby firms can actively search potential buyers. Both channels may be subject to bias however and thereby affect firms' market access. We discussed search ranking bias in the previous section; here we focus on ad ranking bias.

In the offline world the advertiser's problem is finding a receptive target audience for the ad. In the online world digital technology is assumed to increase the effectiveness of ad targeting because it facilitates consumer profiling and targeting on more receptive audiences. Advertisers pay for this service through ad auction mechanisms that

facilitate real-time pricing and targeting of ads in response to search queries. However considerable doubt has emerged in recent research about the effectiveness and return to online advertising for advertisers. Blake, Nosko & Tadelis (2014) find negative rates of return to advertising on eBay. They carry out large-scale behavioural experiments on eBay to measure the effectiveness of paid search ads. They find that the returns from paid search are only a fraction of conventional non-experimental estimates. Ads driven by brand keywords have no measurable short-term benefits. Non-brand keywords ads influence new and infrequent users positively. However, more frequent users whose purchasing behaviour is not influenced by ads account for most of the advertising expenses, resulting in negative average returns. Goldman & Rao (2014) suggests that the prevailing GSP (Generalised Second Price) ad auction mechanism may be to blame for this because it creates bias in the sponsored search rankings and results in much lower conversion rates than assumed. In another paper Lewis & Rao (2015) show the extreme volatility and basic un-measurability of returns to advertising. The old saying "half of my advertising is successful but I don't know which half" still seems to be valid online. In other words, the ubiquitous availability of online targeted advertising has not led to a better targeting of ads.

Does this imply that firms should abandon online advertising? Probably not. Targeting consumers who already know the product or have expressed an interest may not be the right approach. Keywords based advertising and consumer profiling may still be far too crude to yield meaningful rates of return. However, advertising has other functions that driving immediate short-term sales. It has an information function and operates at several levels of cognition in the human brain. It increases product awareness and may affect longer-term behaviour. Firms should perhaps be focusing more on context-driven advertising using social network data, location data, etc. (Vakratsas & Ambler, 1999). Consequently, the more passive search ranking channel remains a very important way to seek matches between firms and consumers. This explains why firms get very upset when they see their rankings suddenly drop in the Google Search algorithm and some may even launch a court case (see Grimmelmann, 2013, for some examples). Search rankings determine online market access costs. On the other hand, search neutrality from the firm's perspective may be as elusive as neutrality from the consumer's perspective.

3.4. Conclusions

There is a growing information asymmetry between large platforms with virtually unlimited data collection & processing capabilities and the limited cognitive capacity of human users. Pasquale (2015) captures this situation in his "one-way mirror" metaphor: large platforms have unprecedented knowledge of personal lives while users know little about the collection and use of their data and how it affects the information that is presented to them. Many internet users have expressed concerns about this information asymmetry. This puts pressure on policy makers to examine these questions. Information asymmetry has important economic benefits because it enables individuals to specialize and increase their productivity. It would be very costly for society to try to eliminate this asymmetry. A more constructive approach is to accept this asymmetry and find ways to limit possible negative consequences. Platforms offer search tools to help users find their way in a world of massive information asymmetry. They filter the available information overload and try to narrow it down to relevant information only. Unfortunately there is no perfect "neutral" search; moral hazard and adverse selection may occur, especially when platforms have conflicts of interest in presenting search results.

We conclude that search neutrality remains elusive. It may be achievable for pure organic searches but even there weights attached to a wide variety of factors are unlikely to fully converge between platforms and users. Neutrality is not achievable in commercial searches since platforms are free to pursue their profit-maximizing

behaviour, just like offline commercial enterprises. There is no a-priori reason for regulators to intervene in this matter, unless search rankings in dominant platforms would distort competition in the market or violate consumer protection rules. To overcome competition concerns in organic search in dominant search engines, regulators could try to impose a separation of ownership of content from ownership of the search algorithm. This has been tried in other network industries such as train networks, telecoms networks and electricity grids – with mixed results.

Advocates of transparency and accountability would argue that platforms with a commercial conflict of interest should declare these conflicts (Pasquale, 2015). If this line of thinking would be extended to offline firms, all of them would have to declare a conflict of interest which would make this rather trivial. Others would push this logic further and demand that websites explain why a particular product or service ends up in a particular position in the ranking or website. That may quickly run into very technical explanations that may be hard and time consuming to follow for most users. Even if the explanations are found, what would the agency do with this? Why would online stores be treated differently from offline supermarkets? Some would argue that search engines benefit from a much wider asymmetric information advantage than offline supermarkets that imposes higher costs on users who want to overcome these constraints. The regulator cannot "correct" or "edit" the search engine; that would run into similar trade-offs between efficiency for the user and profitability for the search engine owner. It is hard to see what criteria the agency would use to rectify search results.

It would be difficult for policy makers intervene in search tools to further improve the efficiency of search without interfering in the distribution of benefits between platform users and platform operators. In other words biases in search engines are not a market failure but a distributional issue. This might be addressed through the EU Unfair Commercial Practices Directive states that "a commercial practice shall be regarded as misleading if it contains false information or … even if the information is factually correct … is likely to cause a decision that he would not have taken otherwise".

4. Platforms and liabilities

In the previous section we discussed how online platforms can reduce information costs for users because search engines facilitate finding a matching party for an exchange. However, reduced information costs come at the cost of more risks. Online platforms enable exchanges of a virtually infinite variety of products & services within a much wider group of users, often without knowing who the counterparty really is.

Exchange among strangers is one of the salient characteristics of modern society. In the offline economy it took several centuries to gradually shift away from proximity exchanges between parties that know each other to long-distance exchange with strangers. This required the gradual construction of an institutional environment that not only reduces transaction costs but deals with credible post-contractual enforcement of commitments (North, 1991; 2005; Williamson, 1976). Today, a high-quality institutional environment is widely accepted to be a necessary condition for economic growth and development. Many countries in the world still suffer from poor quality institutions that make commitment to complex transactions among strangers very difficult (Gutmann & Voigt, 2015). Most of these countries are poor because they have problems in constructing these commitment tools.

The transition from offline to online trade, and particularly online trade on large global platforms, is another leap forward into exchange with strangers that can be challenging, even for affluent and highly developed economies. Offline shops that move online often rely on their offline brand reputation to inspire trust among consumers. Consumers, firms, advertisers, platform operators, etc. suffer from opportunistic behaviour and downright frauds that have a dampening effect on business opportunities. To overcome these online platforms need to design an appropriate institutional environment that enables users to deal with the potential costs and risks in an efficient way.

In the EU, the discussion on the liability of platforms or online intermediaries is usually situated in the legal context of the E-Commerce Directive. According to the E-commerce Directive (ECD) internet intermediary service providers should not be held liable for the content that they transmit, store or host, as long as they act in a strictly passive manner. As a result, the discussion on the liability of platforms often revolves around the question whether they act in an active or passive manner. It is difficult however to draw a dividing line between active and passive platforms. The platform collects information on the content that is offered and feeds that into a matching algorithm that facilitates the exchange and reduces search costs. Platform information analytics and user content are complementary products that are necessary ingredients in an exchange.

Where risks occur, liabilities for these risks need to be assigned. There are at least three parties to an exchange on a platform: two users and the platform itself. Moreover, parties not active on the platform may be affected by the exchange. In this chapter we first examine risks in exchanges between two users and how self-regulation by the platform can mitigate these risks. We then move to contingent liabilities and liabilities of the platform itself. We move beyond the active/passive dimension and look at liabilities from a market failure and regulatory angle. We first examine the sources of market failures that may occur in exchanges between users on a platform and examine to what extent platforms can mitigate these risks through self-regulation and making provisions for contingent liabilities that may occur in an exchange. We then move to the liability of the platform itself, within the context defined by the ECD and in the wider context of implementation of various types of market regulation.

4.1 Self-regulation in platforms

The starting point for this analysis is that information asymmetries abound in platforms. This generates economic benefits but also risks. Platforms can mitigate these risks through various mechanisms, or regulators can intervene. This creates a new balance between market-driven self-regulation and public regulatory intervention that can be different from traditional offline firms and markets.

Search engines reduce information costs prior to the conclusion of a transaction. However, users may also face costs after the conclusion of a transaction. Transactions may not work out as expected, the service delivered may not correspond to the agreed service or to consumer expectations, or an accident happens in the course of service delivery. These are ex-post costs due to uncertainties that emerge after a transaction was agreed. Total transaction costs thus consist of two components: ex-ante information costs and the costs related to ex-post risks or uncertainties.

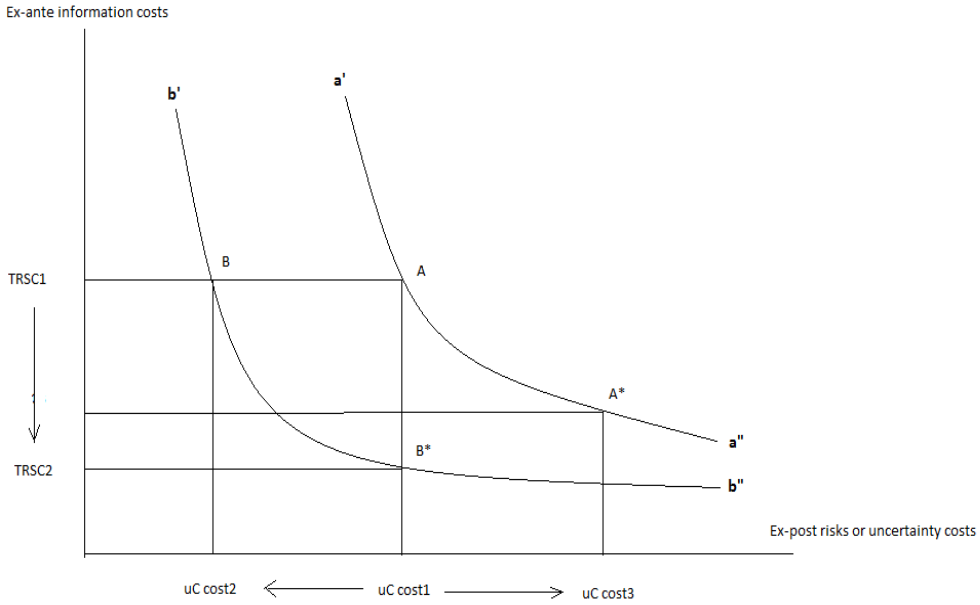
This is illustrated in Figure 4 below. The vertical axis represents ex-ante information costs and the horizontal axis the costs related to ex-post risks. The first are known at the moment of the transaction, the second remain potential and unknown costs. The line a'-a" represents the trade-off between the two sources of transaction costs. The line slopes downwards to the right because more investment in ex-ante information may reduce ex-post risks. Some of these ex-post problems may have been known to one of the parties in the deal. In economics jargon this refers to moral hazard and adverse selection because of incomplete and asymmetric information between the parties and opportunistic behaviour by one or more parties. Parties can try to design a contract that reveals all relevant information and minimizes this asymmetric information. It can never be completely eliminated however. Negotiating and writing out more complete contracts is costly. Users often take a standard contract because it saves ex-ante information costs. Apart from opportunistic behaviour, some ex-post costs may be totally accidental and unexpected and outside the control of both parties. Car accidents, fire and explosions, technical breakdowns, unexpected delays, etc. are typical examples.

Consider the following example. A customer is used to booking hotels via a travel agency. He gives instructions to the agency to select hotels among well-known brand names so that he has a good idea what sort of service quality he can expect. Now a hotel booking website enters the market. The customer no longer uses the travel agency but goes directly to the website and selects a hotel. He can choose the same brand names if he wishes. However, the booking site shows a much wider variety of alternative hotels in the same location. Will he choose any of these alternatives? In the absence of additional information on the quality of these hotels he will probably stick to the well-known brand names. The site also provides consumer ratings for these hotels and gives additional information on their location, facilities, etc. It may help the customer to change his choice and still being fairly confident that it matches his quality preferences.

This process is explained in Figure 4. Prior to the arrival of an online hotel booking platforms the customer is in position A, characterised by high ex-ante information costs and relatively low ex-post or residual uncertainty. He reduces ex-post risks by sticking to well-known brand names and the star rating system of the hotels association – a centralised sectorial regulatory body. The curve a'-a" reflects the trade-off between ex-ante and ex-post costs in at transaction. When the booking site arrives, information costs drop. However, if he wants to make full use of the increased variety offered, ex-post risks are likely to increase. He can shift to A* but he may not like this risks associated with that position. If he stays in position A a market failure occurs: consumers cannot make full use of the benefits offered by the reduced information costs because this entails other sources of costs. The booking site decides to do something about this market failure. Rather than relying only on the hotel sector regulator for star ratings, it introduces its own more flexible hotel rating system, based on consumer review scores. This makes it possible for customers to reduce ex-post risks. It implies a shift in the institutional quality trade-off from a'-a" to b'-b". For a given amount of

search time and information costs, the customer now ends up in point B* where he fully exploits the reduction in information costs while still not exceeding the level of ex-post risks that he feels comfortable with. Very risk aversive customers could exploit this institutional quality improvement by moving to point B and thereby signal their preference to use the information cost reduction for risk reduction purposes rather than exploring wider variety of choices. The consumer review scores allow them to do so.

Figure 4: The trade-off between ex-ante information costs and ex-post risks



In this example, the introduction of consumer review scores it a form of market-based auto-regulation by the hotel reservation platform. It is a public good for all platform users that generates a welfare improvement for consumers. Risk management in online exchanges has been a key challenge as well as a driver of success for many online platforms, both B2C platforms like Amazon and eBay, and collaborative economy platforms like Airbnb and Uber. In order to get their platforms started and speeding up they need reputational mechanisms that enable all sides of the market to provide feedback. Collaborative platforms that facilitate direct interactions between individuals are even more prone to reputational risk issues since individuals usually don't have a well-known brand name to start with.

We can distinguish between two types of ex-post risks. First, there are risks generated by asymmetric information between the contracting parties that result in opportunistic behaviour, moral hazard and adverse selection. These risks can be controlled by the contracting parties through appropriate incentives to reveal relevant information. Second, some risks however are created by factors outside the control of the contracting parties: unforeseen circumstances, fires and explosions, accidents, etc.

In the latter case self-regulation cannot reduce ex-post costs. For example, the accommodation booking site AirBnB. Customers can now make room reservations in private houses that are not formally registered and recognised hotels. This generates new sources of ex-post uncertainty. While there is variance in the quality of the hotel star rating system there is probably much more variance in the quality of accommodation offered in private houses. Moreover, hotels offer some regulated

guarantees with regard to consumer protection, fire escapes and accident insurance, etc. Who is responsible in AirBnB when a customer falls down the stairs or a fire breaks out? This is an insurance-type risk. Customer review ratings cannot provide any information on accident insurance. Contingent liabilities cannot be covered by reviews or by providing additional information on the quality of a service. Still, platforms can take action to remedy this market failure, for example by imposing insurance requirements on all accommodation service suppliers, or offering the possibility to join a collective insurance mechanism organised by the platform, or an insurance policy available in the market, if any. Platforms often take collective action to overcome potential market failures. It is in their own interest to do so in order to attract more customers to the platform. For instance, free product returns in e-commerce platforms reduce the risks of ex-post dissatisfaction with the delivered product. Liability insurance can either be imported from the offline economy or developed separately to match the specific circumstances of online transactions. Online taxi services and ride hailing companies for example are trying to develop accident insurance policies adapted to collaborative economy platforms.

The shift to online digital transactions on platforms may also create new problems in liability insurance mechanisms. For example, car insurance companies can now collect detailed data on driving behaviour of their clients that enables them to adjust insurance pricing to behaviour. While prices may sink for cautious drivers, less cautious drivers may be confronted with prohibitive prices. That increases the risk of underinsurance for those categories that need it most. Detailed personal data collection put pressure on a basic principle of insurance: the pooling of risks in larger groups. If individual risks can be identified and separated in the pool, the pool fragments and risks of underinsurance increase. Similar risks may occur in health insurance where detailed data on consumer behaviour, including food, drinking and smoking habits and involvement in more risky professional and leisure activities may affect insurance pricing and push those who need it most out of the insurance market. Regulatory intervention might be required to prevent such market failures.

These simple examples explain the relevance of private market design and self-regulation for online platform markets. Platforms can leverage their access to data and data collection capacities to improve the institutional set-up by adding mechanisms that reduce ex-post uncertainty, for a given level of ex-ante transaction costs. Information technologies can be leveraged to mitigate at least part of these risks through peer reviews, consumer scores and rating systems. In the offline economy, regulators sought to compensate asymmetric information problems with regulatory standards for hotels and taxis for example: a star rating system for hotels and costly regulatory entry barriers for taxi services. In the online economy, consumer review scores for hotel and taxi services provide a much more detailed feedback on the quality of service providers while lowering the entry barriers. Libertarians have argued that centrally regulated quality standards can be abolished and replaced by decentralised rating systems. This may be true for some regulatory standards but not for all.

Public regulators should then carefully consider the new situation that occurs with the arrival of self-regulation in an online platform and whether there are any remaining market failures that need to be addressed through public regulation because the platform has no means or no incentives to address the remaining issues. This implies that a straightforward extension of existing regulation from the offline economy to online platforms is not necessarily a good solution. Offline and online operators in the same market should not necessarily be ruled by the same regulation; everything depends on the extent of self-regulation and the balance with public sector regulation.

4.2. How robust is self-regulation?

The reliability of online reputational ratings is a topic of research[5]. Some authors claim that ratings reduce information asymmetry and are a reliable form of self-regulation ensuring consumer protection and security that should not altered by any form of regulatory intervention (Allen & Berg, 2014; Cohen & Sundararajan, 2015; Koopman et al., 2014, 2015; Sundararajan, 2014; Thierer et al., 2015). In practice, however, there are a number of reasons why such ratings may not be fully reliable. There is also a large literature on trust and reputation systems (Nosko & Tadelis, 2015; Pallais, 2013) that dates back to early work by Resnick and Zeckhauser (2002) and to Bajari & Hortasu (2004).

Online exchange faces intrinsically two sources of information asymmetry to be dealt with. The first concerns the identity of counterparts (Ba, 2001; Pavlou & Gefen, 2004): unidentified, anonymous, and impossible to link to a physical person. The second regards the quality of the object (good or service) of exchange (Gefen et al., 2008; Jøsang et al., 2007). The online consumer often needs to pay before receiving and experiencing the good or service. Identification and verification systems address the first, reputational ratings deal with the second. Reputation ratings work on the assumption that reputation is a 'value' that can influence the capacity to exchange or sell a particular good or service (Burnham, 2011). When the parties are total strangers to one another reputation systems are collaborative filtering mechanisms that facilitate the emergence of generalised trust (Corritore et al., 2003). Reputational ratings are a social control mechanism whereby the members of an online community police themselves (Abdul-Rahman & Hailes, 2000; Ba, 2001). A second mechanism with the capability to increase trust in online P2P marketplaces is the implementation of social networking features, or the leveraging of pre-existing relationships (and by extension, existing pre-established trust) from the social graph of an individual. Websites that require a sign-in through Facebook accounts for instance import pre-existing trust relationships. This has two purposes: it confirms identity and it establishes transitive trust (Hogg & Adamic, 2004; Jøsang, et al., 2007; Kwan & Ramachandran, 2009; Swamynathan et al., 2008). The trust transitivity principle refers to "The idea that when Alice trusts Bob, and Bob trusts Claire, and Bob refers Claire to Alice, then Alice can derive a measure of trust in Claire based on Bob's referral combined with her trust in Bob" (Jøsang et al. 2007: 624).

There are a number of potential shortcomings with reputational ratings that may undermine their reliability. There are two main sources of bias: under-provision of ratings and strategic behaviour in provided ratings. Leaving an accurate rating is a public good and is likely to be under-provided (Avery et al., 1999; Miller et al., 2005). A user may not always leave a rating and the distribution of his/her evaluations may not accurately represent the outcomes of that agent's previous transactions. It has been shown, for instance, with data from eBay, that buyers and sellers with mediocre experiences review fewer than 3 per cent of the time (Dellarocas & Wood, 2007). In two sided reviews systems users may provide more positive ratings than their true evaluation to avoid retaliation. The review mechanism itself becomes an object of trust and repeated interaction between community members. When eBay had a two sided review system, over 20% of negative buyer reviews were followed by negative seller reviews, interpreted by the authors as retaliation (Cabral & Hortacsu, 2010; Saeedi et al., 2015). On the other hand, an experiment has shown that a system in which reviews are hidden until both parties submit a review ("simultaneous reveal") reduces retaliation and makes markets more efficient (Bolton et al., 2012). Fear of retaliation or intentional collusive behaviour with friends can lead reviewers not to reveal their experiences in the review. In various studies it has been documented that some users who anonymously answered that they would not recommend their counterpart nonetheless submitted a public review giving a five star rating. Furthermore, social communication can lead

[5] This section borrows extensively from Codagone (2016a).

reviewers to omit negative comments due to two reasons. First, conversation can cause buyers and sellers to feel empathy towards each other (Andreoni & Rao, 2011). This may cause buyers to assume that any problem that occurs is inadvertent and not actually the fault of the seller. Second, social interaction may cause buyers to feel an obligation towards sellers because those sellers offered a service and were "nice" (Malmendier & Schmidt, 2012). This obligation can lead buyers to omit negative feedback because it would hurt the seller or because it would be awkward. Whatever the sources, these biases may reduce market efficiency and, for example, may cause users to engage in suboptimal transactions (Horton & Golden, 2015; Nosko & Tadelis, 2015).

Several empirical studies document the quality of reputational ratings in collaborative economy platforms (Cullen & Farronato, 2015; Fradkin, et al., 2015; Horton & Golden, 2015; Lauterbach et al., 2009; Overgoor et al., 2012; Zervas et al., 2015). The first two studies focussed on CouchSurfing and using big data scraped from the web conclude that there is a bias toward positive reviews and that there can be collusive reciprocity among individuals belonging to the same network (Lauterbach, et al., 2009; Overgoor, et al., 2012). A comparison of the distribution of reviews for the same property on both TripAdvisor and Airbnb shows that ratings in the former are lower than those on Airbnb by an average of at least 0.7 stars (Zervas, et al., 2015). More generally, the share of five star reviews is 31% on TripAdvisor and 44% on Expedia (Mayzlin et al., 2014) compared to 75% on Airbnb. This difference in ratings could be interpreted as showing that two-sided reviews systems induce bias in ratings. A recent study involving researchers affiliated with Airbnb document that there are some bias but also that when such biases are removed through experimental manipulation the five star ratings on Airbnb remain substantially higher than 44% (Fradkin, et al., 2015). This would imply they are a reliable measure of quality to inform other consumers. The study of another platform (Elance oDesk) documents through a laboratory experiment that reputational ratings are fairly inflated (Horton & Golden, 2015). Nosko & Tadelis (2015) go a step further and examine how the platform can leverage seller reputations to improve the overall experience of buyers on a platform and internalize the negative externalities that poor seller reputations may have across the entire group of sellers on a platform. They propose to integrate a new measure of expected positive results in the search rankings of the platforms so that buyers get more exposure to higher quality sellers and lower quality sellers are downgraded in the search rankings. They run experiments with this mechanism to internalize same-side externalities on eBay and find that this improves the overall consumer experience and likelihood of return buyers on the platform.

We conclude from this short review that many online platforms are making substantial efforts to use their information collection capacity to improve the user experience and reduce the post-contractual risks created by asymmetric information. In principle, more detailed information collected by platforms at the user level could produce more reliable insights than centralised standards with high entry costs. However, the evidence is inconclusive and varies considerably from platform to platform. This may suggest that there is a role for public sector regulators to supervise the quality of sector-specific attempts at self-regulation and possibly set meta-standards for self-regulation without intervening directly in the self-regulation efforts.

4.3 Platform liability for copyright-protected content

So far we examined the risks and liabilities that occur in online transactions between users in platforms. In this section we look at the potential responsibilities and risks for the platform itself. In this section we approach this question via the definition of liability of online intermediaries in the EU E-Commerce Directive. In the next section we will take a wider view that goes beyond the E-Commerce Directive (ECD).

According to the ECD internet intermediary service providers should not be held liable for the content that they transmit, store or host, as long as they act in a strictly passive

manner. Art 14 of the ECD specifies that they cannot be held liable for illegal content provided that they do not have knowledge of illegal activity or upon becoming aware they act expeditiously to remove or disable it. This has given rise to a wide variety of so-called "Notice & Action" procedures. However, assessing the illegality of content or activities is a significant challenge for intermediaries. As a result removal of illegal content can be slow and complicated while content that is actually legal may be taken down erroneously. Illegal content includes a wide range of issues, including infringements of intellectual property rights (trademark or copyright), child pornography, racist and xenophobic content, defamation, terrorism or violence, illegal gambling, illegal pharmaceutical offers, illicit tobacco or alcohol advertisements, etc.

The E-commerce directive provides a "notice & action" procedure for illegal content. Stakeholders can notice the platform of such content on their website and the platform should take it down as soon as possible. This procedure is frequently invoked for copyright-protected content (music and film, news media and pictures). The question has been raised whether the notice & take-down procedure and responsibilities should be strengthened in the face of an increasing proliferation of (potentially) copyright-infringing content on online platforms. As such, this question sits at the interface between the on-going debate on the reform of the EU Copyright Directive, including user-generated content issues, fair remuneration for rights holders and the "value gap" debate.

The platform angle comes into the debate because digitization has lowered the production and distribution costs and created social media platforms that enable very rapid distribution of different types of contented uploaded by users. Content is not necessarily a straight copy of the original product of the rights holder. It may be user-generated content or mash-ups that contain some elements owned by the original rights holder, it may be very short extracts or snippets of protected contents, or lower quality versions of that content. From an economic perspective, this opens a debate on complementarity versus substitution between the original content and the uploaded version and the related incentive for rights holders to take down or tolerate (if not benefit from) this newly generated content.

This has led to debates for example on the role of YouTube as a complement or substitute distribution channels for original audio-visual and music content and how it affects the remuneration of the rights holders. YouTube argues that is channels considerable revenue to the rights holders. Rights holders are not satisfied however and claim more revenue. A similar debate has erupted in the news media industry where news aggregators reproduce titles and short snippets of text extracted from original online newspaper publishers. Again the question turns around substitution or complementarity between these two distribution channels and the distribution of revenue between new aggregators and original news publishers. The limited empirical evidence available to date (Chiou & Tucker, 2015; Athey & Mobius, 2012; Delarocas et al, 2015; NERA Economic Consulting, 2015) indicates that the net effect of news aggregation platforms is to re-direct more traffic to the original newspapers publishers' websites than what they take away from these sites. They are complements rather than substitutes. There is no empirical evidence yet on the overall welfare impact of news aggregators, including the impact on consumer welfare. This societal perspective would be important for policy makers. Policy initiatives in Spain and Germany in recent years to give more rights to the original news publishers and bolster their negotiation position with the news aggregators have so far not produced any tangible results.

4.4. Platforms and intermediary liability

In this section we move beyond the e-Commerce Directive and responsibility for illegal products to a wider interpretation of intermediary liability that relates to the enforcement of rules & standards in goods, services, capital and labour markets. This

includes consumer protection, social security and labour market regulation, technical standards in goods & services markets, etc. The existing regulatory environment is designed for traditional offline firms, retailers and independent workers. However, new types of online exchanges do not necessarily fit well into this existing regulatory *acquis*. Digitization and the shift to online sales has created two new categories of "firms" at opposite ends of the size spectrum: (a) large online platforms or market places that are different from traditional retail stores and enable direct interaction between producers and consumers and (b) a sub-category of collaborative or sharing economy platforms where goods and services are not produced by established "firms" but by individual producers who are not necessarily subject to the same regulations as "firms" (Codagnone & Martens, 2016). Moreover, there are many in-between hybrid versions of these standardized types. Policy makers are now starting to think about how to adapt regulatory instruments to the specific circumstances of online transactions and the new typologies of "firms" or platforms that have emerged in this environment.

There competition between established offline firms (some with online shop windows) and new types of online platform-mediated services delivery. Whether they are substitutes or complements remains an empirical debate. That competition has led to calls to establish a regulatory level playing field between offline and online "firms" in similar sectors. A knee-jerk reaction would be to simply extend the domain of application of existing regulation to these new types of online markets. That reaction fails to take into account the rationale why the regulation was created as a response to market failures and whether these failures are the same in offline and online markets. Online markets may operate under very different conditions that may be subject to less or different types of market failures, enable some degree of self-regulation in markets and therefore require less or different regulatory responses (see Section 4.1 above).

Collaborative economy platforms where goods and services are produced by natural persons that are not subject to the same regulatory provisions as legally established firms, are particularly challenging for regulators. Regulators face two extreme solutions: laissez-faire or extending the existing regulation to natural persons who provide these services. Often, an in-between solution is proposed that consists of a partial extension of existing regulation. For example, hotel sector regulation is applied only to AirBnB accommodation suppliers who rent out their real estate more than 60 days per year, or Uber taxi drivers are considered as independent workers if they do not work more than 15 hours per week. These are no doubt genuine attempts to find a compromise solution and help sharing platforms avoid some of the fixed regulatory costs that would be hard to amortize for small-scale operators. They are attempts not to block innovation while keeping a minimal regulatory oversight on these new activities. However, they segment the market and by-pass the rationale for the existence of the regulation. Do AirBnB consumers need less protection if they happen to stay at a place that is rented out less than 60 days per year? Why can independent plumbers and electricians work more than 15 hours per week and an independent Uber driver less than 15 hours?

Another type of regulatory response to these challenges revolves around the extent of active or passive involvement of a platform in the exchange that is taking place on its virtual market place. This approach is inspired by the e-Commerce Directive that makes a distinction between passive "hosting" and active involvement. This distinction becomes very blurred and subjective in many types of online platforms and business models. To what extent are Facebook and YouTube actively involved in uploading content and facilitating an exchange between users? A more economically meaningful would be to assign the responsibility to the party that has the best information and can implement legal or regulatory standards at the lowest cost. Because of its central position as data collector and information exchange, the platform is often best-placed for monitoring and surveillance of the market. For example, AirBnB is best-placed to know who rents out real estate in a city and how much revenue from that activity should be declared to the local tax authorities. It is not well-placed to check if the place meets fire safety standards but it could signal the need to check it up to the competent authorities.

Existing regulation for traditional transactions often turns out to be more costly and less effective than new platform-based transactions. Platform-mediated transactions may leverage their data collection capacities to put in place powerful self-regulation capabilities in a number of areas, though not in all areas where market failures may occur. For example: Taxi licenses are often a costly entry barrier into the taxi sector and a source of regulatory rents for incumbents that translate into high consumer prices. The qualifications required to obtain a license may provide some quality guarantees to consumers. Online ride hailing services have much lower entry costs, result in much lower prices and more availability. At the same time, rating systems for drivers provide users with continuous service quality monitoring rather than one-off licensing systems. However, ride apps are not in a position to check the safety and roadworthiness of the car; that requires traditional regulatory intervention. Similarly, online accommodation platforms can provide continuous and fine-grained monitoring of service quality standards that provide better insights than the star-system in traditional hotels. Still, they cannot adequately monitor safety standards for example.

Meta-regulatory supervision and complementary public sector regulation will still be required. Search rankings and rating systems may create new types of potential market failures that did not exist in the offline economy, or at least where far less prevalent in that environment. This may require new types of regulatory interventions that focus on monitoring and supervision of self-regulatory initiatives in the online economy. The balance between self-regulation and government oversight should be carefully reconsidered in the context of these innovative technologies and the new market conditions that they create. That re-examination may also be an opportunity to eliminate regulatory capture by special interest groups. Regulation should not protect incumbent business models but support welfare-enhancing innovative business models.

The largest online platforms are mostly multinational businesses. Regulators should be aware that it often hard to define the geographic borderlines of platform activity. It may go far beyond the territorial jurisdiction of the regulator or legislator. Regulatory geographic fragmentation can be detrimental to societal welfare. Large online platforms often have a global reach, on each side of the market. This can lead to complex geographical combinations and jurisdiction questions. An online shop based in China can sell Vietnamese goods to EU consumers: which technical standards and regulatory regime applies? An online worker in India can perform tasks via a US task outsourcing platform for a firm based in the EU: which labour market regulation applies? Who would have thought a few years ago that inherently local services such as taxis would become a multinational service, managed from San Francisco?

This is challenging not only for domestic regulatory regimes in the EU but also for the international trade agreements and trade standards that govern EU trade with the rest of the world. Non-EU platforms operating in the EU will put pressure on existing bilateral and multilateral services trade agreements and trade restrictions. So far the EU online market was dominated by large US platforms, often with local establishments in the EU. Large Chinese platforms are now rapidly making deep inroads into the EU market. Others will follow. We cannot design a regulatory regime for EU online platforms buying & selling in the EU only. That is only part of the online market and would quickly lead to unequal treatment and displacement of platforms outside EU jurisdictions. Designing regulation becomes very difficult in a globalised market place for goods, let alone for services. The EU is well-placed to avoid regulatory fragmentation in the Digital Single Market and handle the international trade aspects of online regulation.

5. The use of data in platforms

In this section we turn our attention to the fuel that drives users' search and matching, the data that platforms collect. Rieder (2014, 2015) identifies two types of challenges arising from data analytics: monopolization or "concentric diversification" and accountability issues arising from advanced algorithmic techniques, including machine learning. Concentric diversification could be translated into economic jargon as economies of scope. Companies expand their data collection & analytics into adjacent data areas where joint analysis of the existing and additional data gives them a comparative advantage over companies that separately analyse data in a particular area. Machine learned algorithms may take important decisions that affect human behaviour while the rationale behind these decisions is not always clear. The sheer volume of data collected, the way these data are processed and used in algorithms and the impact of these algorithms on human behaviour and decision making raise concerns about loss of individual autonomy, transparency about the workings of these algorithms and accountability of the algorithm operators. Pasquale (2015) aptly calls this "The Black Box Society". The more fundamental underlying question is the rapidly growing information asymmetry between powerful data processing systems and human cognitive capacity and the consequences for human values of individual freedom and autonomy, and whether transparency and accountability can solve these issues.

5.1. Economies of scope in data

In Chapter 2 in this report we already pointed out that the economics of platforms has gradually moved away from a focus on network effects only to a wider picture that focuses more on the data collection and processing capacities of platforms. Fundamentally, pure platforms do not produce goods, services or content; their activity revolves around data analysis. The underlying economic feature of data processing is "economies of scope": joined datasets usually provide more insights and/or are cheaper to process than separated datasets.

Platforms have an advantage over traditional firms because they benefit from economies of scope in data collection and use. Traditional firms can only collect information about their own behaviour and the relationship with their own clients. Platforms can collect data and aggregate them across all firms and consumers on the platform. The aggregated information has more value than the individual datasets that users can observe. Larger datasets are more efficient than smaller sets, up to the point where diminishing returns become zero or even negative. Economists refer to this characteristic as "economies of scope" (Rosen, 1983). This birds' eye view of markets turns platforms into more efficient matchmakers between users compared to individual firms. This explains why traditional firms worry about data driven competition from online platforms. The efficiency gains from economies of scope may gradually diminish however. Scattered empirical evidence suggests that in some cases diminishing returns may set in at a very early stage (Pilaszy & Tikk, 2009, on film selection) while in other cases it only arrives when the number of observations increases many orders of magnitude (Varian, 2014) or never (Lewis & Rao, 2015, on the efficiency of online advertising). These are empirical questions that cannot be answered by a-priori theoretical reasoning; they should be explored on a case-by-case basis.

The question can be further expanded beyond data collected by platforms for their own use. Some data may be shared or traded with third parties on data markets. An important role in the data market is played by data intermediaries, firms that are specialised in the collection, aggregation and onward sale of personal data. The US Federal Trade Commission held an inquiry (FTC, 2014) into the US market for data traders or data brokers. Data traders collect consumer data from numerous commercial

and public sources, largely without consumer knowledge, including consumer purchase data, web browsing activities and details of consumers' everyday interactions. While each broker may provide only a few data elements about a consumer's activities, data brokers can put all of these data elements together to form a more detailed composite of the consumer's life. The data trade covers data on nearly every US consumer and vast numbers of commercial transactions. Data are used to make inferences about consumers, some potentially sensitive such as religion, ethnicity, education and income levels, marital status, etc. They rely on websites cookies to target Internet advertisements to consumers based on their offline activities. Some data brokers are using similar technology on mobile devices.

Economies of scope also apply to machine learning and to mergers and transactions between firms that own machine learning algorithms. Recently, machines have been programmed to learn by means of self-improving algorithms that are good at discovering complex patterns in relatively unstructured large datasets (Liran et al). Machines can discover patterns in very large datasets that are beyond the cognitive capacity of humans to handle, though the machines often need human support to discover these patterns. The algorithms learned from one dataset may in some case be transposed to other datasets. Learning obtained in a smaller dataset can be extended to expanded versions of the dataset. Extension to adjacent data areas can also generate economies of scope. For example, machine learning applied to mobile phone location data can generate mobility patterns, for individuals and groups. The phone data can be overlaid with maps and with shops & restaurants data; applying the same algorithms and building on the observed patterns in phone data can produce even more insightful patterns, on top of those already observed in the phone data. Combining it with pay data in shops & restaurants adds further insights, etc. Applying machine learning algorithms separately to each of these datasets may be more costly and would not produce the same complexity of insights.

From a societal perspective, economies of scope are a source of economic benefits because they generate cost savings (in data collection & analysis), reduce search costs for platform users and enable new types of transactions – and thereby boost innovation. However, they also lead to policy dilemmas. Economies of scope lend support to the view that more data integration is better. Mergers between firms with non-overlapping datasets can be economically beneficial. Similarly, data trade may be potentially beneficial to firms and consumers. The use of data for other purposes than those originally intended can generate efficiency gains too. More data collection about a consumer enables a firm to better respond to search requests and other online services. The regulatory instruments with regard to data protection and competition indicate that there may be limits to more integration and that it could be harmful. Policy makers are walking a thin line in crafting a balance in this equation.

In the EU, the Data Protection Regulation (2012, 2015) provides for the right to access personal data – provided the consumer is aware that a firm has collected his personal data. The data subject is entitled to access, correct and delete his data ("the right to be forgotten") or transmit them to another system ("portability of data"). The GDPR states that the free movement of data in the EU is not restricted (Art 1(3), presumably implying movement across borders. Whether that also implies trade between firms is not so clear. Art 5(b) states that data can be collected for specific, explicit and legitimate purposes but should not be processed for any other "incompatible" purposes. A secondary purpose is not prohibited but should not be "incompatible" with the original purpose for which the data were collected. If data trading companies pursue compatible purposes trade may be legitimate but this is highly unlikely. A report by the EDPS (2014, p 27) suggests that if the two uses of the data (within a single firm or between two firms) are in completely separate and non-substitutable markets they might be incompatible.

5.2. The economics of privacy and consumer dilemmas

According to Acquisti et al (2015) [6] the internet was originally designed with a decentralised and open architecture and possibly anonymous interactions. Today technology has advanced to the point where firms are in a position to track and link behaviours across websites for billions of users, often without their knowledge or explicit consent. This situation has no precedent in human history.

Privacy considerations leave the consumer with a dilemma. There is a positive trade-off between sharing personal data and getting better services. The efficiency of online services such as search can increase by giving these services more access to personal data. On the other hand platforms may use this information for other purposes than to reply to a search query. They may use personal data to promote ad sales or simply sell the data to other platforms. Since the data subject is uninformed about these additional uses of his data and has no meaningful way to assess the implications, there is a risk involved. This creates a trade-off between ex-ante information costs and ex-post risks (see Chapter 4). He may prefer to release less personal information and reduce these risks but consequently face higher search costs.

Economic and social theory can reflect on the costs and benefits of privacy but ultimately this is an empirical issue. Privacy protection can both enhance and reduce individual and societal welfare. Individual decisions about privacy are hindered by the lack of information about which data is collected, for what purposes, and the consequences of sharing or protecting their data. Informed consent is not realistic in these circumstances. On top of the difficulty of individual decision making, personal data can generate positive and negative externalities for society that go far beyond individual decisions. Personal information has characteristics of a public good, such as non-rivalry and non-excludability. Data have peculiar economic characteristics that are different from ordinary goods and services. Contrary to ordinary goods, data are non-rival: several persons or machines can use them at the same time, without any loss of benefits for the others. This makes exclusive ownership of data more complex than for ordinary goods. Others can be excluded from access to the data by law (for instance IP rights, data protection legislation) or by commercial strategy (secrecy for instance).

These characteristics have enabled the emergence of a complex ecosystem where personal data collection, analysis and transmission generate costs and benefits. In the online advertising ecosystem personal data is continuously traded among firms in a complex and decentralized system (Olejnik et al., 2014). There are multiple markets in which data is traded and privacy is sought or purchased (cf. Lane et al., 2014). Consumers do not have access to those markets: they cannot buy back their data or offer their data for sale. While personal data protection policy revolves around the ability to keep that information protected it is in fact hard to prevent released data from being duplicated and accessed by other parties, or to control its secondary uses. The flip side of this trend is increasing pressure on individuals to share more data, as can be observed for instance in the increasing number of online services that require logging in through personal social media accounts.

Taking into account the difficulties that individuals face in making informed privacy decisions and the presence of strong externalities in personal data usage, leads us to conclude that personal data decisions and market outcomes are unlikely to reflect individuals' true privacy valuations (Berthold and Bohme, 2010) or the wider social value of personal data. This widespread market failure would constitute a strong argument for regulatory intervention in private data markets. However, the regulators' problem is equally complex as for individuals: how to intervene - more or less privacy protection - and under which conditions? What is the appropriate balance between individual

[6] This summary draws extensively on a recent literature review on the economics of privacy by Acquisti, Taylor and Wagman (2015).

protection and disclosure decisions, competitive markets and government regulation that best serves the interests of individuals, firms and society as a whole? How should the welfare surplus generated by the unprecedented volume of private data in digital societies be allocated? Should the allocation favour the individual as the owner of the data or the firm that invested in collecting and analyzing the data?

The economic study of privacy tries to address these questions. Acquisti et al (2015) distinguish three stages in economic research on privacy. The "First Wave" focuses on overall private data market (in-)efficiencies. Posner (1981) argues that the protection of privacy conceals potentially relevant information from other economic agents. Stigler (1980) argues that regulatory interference in the market for personal information is destined, at best, to remain ineffective. Hirshleifer (1971, 1980) asserts that rational economic agents may end up over-investing in collecting personal information about other parties.

Who should hold a claim over personal data, the data subject or the firm that invested in collecting the data? In line with the Coase Theorem (Coase, 1960), Noam (1997) argues that what happens to personal data does not depend on the initial allocation of rights in a privacy regulatory regime but on the relative valuations of the parties interested in the data. The regulatory regime will only affect who pays who for access to and protection of the data (data subjects or data holders). The allocation of privacy rights has allocative and distributional consequences that affecting the surplus of various parties, even though it may not affect aggregate welfare. In a similar vein, Laudon (1999) argues that protection of privacy is outdated and a system of private property rights over personal information would satisfy the interests of both consumers and firms because it facilitates trade in personal data. Acquisti et al (2015) however argue that while the assignment of property rights is generally welfare enhancing, granting consumers the right to sell their personal data may actually undermine consumer surplus. The Coase Theorem only works when transaction costs are zero. Non-zero positive transaction costs will lead to obstacles and inefficiencies in the allocation mechanism. There are plenty of potential sources of transaction costs including costs for individuals to keep track of data exchange contracts (see below).

The EU does not recognize private ownership rights on personal data (it does on commercial data through IP rights). It does however recognize essential rights to privacy protection. There is a debate among researchers on the merits of recognizing private ownership of private data, but no consensus. Moreover, in a digital world, data are in principle fully interoperable: any dataset can be linked to any other dataset, irrespective of distance, carrier and format. Interoperability can further boost economies of scale and scope. However, for privacy or commercial reasons we may not want all datasets to become fully interoperable (Gasser & Palfrey, 2012).

The "Second Wave" in the 90s is characterised by progress in digital information technologies on multiple fronts and the establishment of markets for personal data. Varian (1997) echoes Stigler's and Posner when he recognizes that consumers may suffer privacy costs when too little personal information about them is being shared with third parties, rather than too much. However, he adds novel concerns associated with the secondary usage of personal data.

The "Third Wave", starting at the turn of the millennium, sees the emergence of a more complex privacy economics landscape, rooted in more formal economic models and in empirical analyses, including behavioural laboratory experiments. Acquisti & Varian (2005) demonstrate that consumer tracking will raise a merchant's profits only if the tracking is also used to provide consumers with enhanced personalized services. Calzolari & Pavan (2006) find that the transmission of personal data from one company to another may in some cases reduce information distortions and enhance social welfare. Campbell et al. (2015) demonstrate that consumers are more likely to grant opt-in consent to large networks with a broad scope rather than to less well-known firms. Hence, if regulation focuses only on enforcing an opt-in approach, users may be less

likely to try out services from smaller firms and new market entrants, potentially creating barriers to entry. Firms with market power may benefit from committing to privacy policies.

The use of personal data for targeted advertising raises questions about the potential benefits and costs of advertising for consumers and firms. Some researchers claims that consumers benefit from targeted product recommendations (Anand and Shachar, 2009). However, platforms seldom have optimal incentives to match consumers with products (see section on biases in search). Improving matching in search by disclosing consumer information to firms selling on platforms might be too costly for a platform because it would pass the informational rent that it enjoys on to firms. This may explain why personalized advertising markets are ineffective (Lambrecht and Tucker, 2013; Blake et al., 2015) for firms that advertise on platforms. Rao (2015) attributes this to the inefficiencies in the auctioning mechanisms for online ads. Goldfarb and Tucker (2011b) find that following the ePrivacy Directive in the EU, banner ads experienced a reduction in effectiveness of over 65% in terms of changing consumers' purchase intents. Clearly, privacy regulation may be detrimental for the advertising industry. Is it detrimental for consumers? This depends on whether advertising is more persuasive or informational. Goldfarb & Tucker (2011) find that obtrusive targeted ads - matched to the content of a website and highly visible - are more likely to trigger privacy concerns.

There are persistent concerns that private data might be used for price discrimination. Mikians et al. (2013) find some evidence of price discrimination based on consumer data, as well as evidence of discrimination in search results. They find substantial price differences for identical products based on the geographical location of the consumer. This has also been confirmed in the 2015 EU Mystery Shopping Survey (GfK, 2016; Cardona, 2016). Vissers et al. (2014) find no evidence of consumer-based price discrimination in online airline tickets. There seems to be some anecdotal evidence of personalized price discrimination but no systematic evidence.

There is also widespread evidence of consumer concerns about privacy protection and the use of their personal data, both in the EU and in the US. The Pew Research Center finds that 68% of US adults believed that current laws are insufficient to protect their privacy. At the same time, most consumers remain avid users of information technologies that track and share their personal information with unknown third parties. This is known as the "Privacy Paradox". Acquisti et al (2015) argue that the paradox may not actually exist. Consumers express general attitudes in these surveys whereas behaviours are decided for specific circumstances. Nissenbaum (2004) shows that privacy concerns and expectations are very context-dependent. People routinely engage in mental trade-offs of privacy in specific circumstances. Also, the observation that people generally seem not to aggressively protect their online privacy does not justify the conclusion that they never do so. It is more likely that the purported dichotomy between privacy attitudes and privacy behaviours is actually the result of many, coexisting, and not mutually exclusive different factors.

The privacy paradox was often interpreted as a generational issue with younger people feeling less concerned about privacy. Blank et al (2014) show that the reverse is actually true: younger and more intensive internet users are more aware of privacy concerns and take more protective measures. The objective of the EU GDPR is precisely to shift that trade-off to a more favourable position by reducing the risks, notably by giving users more control over their private data. Brandimarti & Acquisti (2012) show that this may have adverse effects. When users get more control on the publication of their data they feel more relaxed about privacy and release more private data, even when they have no control on the use of their private data.

The US and the EU have taken very different positions in the debate on the regulation of private data use. The US has taken a limited, sectorial, and ad-hoc regulatory approach, often opting for providing guidelines rather than enforcing principles. This includes the introduction of a Do-Not-Track mechanism, similar to the Do-Not-Call list for telephone

numbers. That prevents users from receiving certain types of targeted ads. However it does not stop advertisers or sites from collecting data.

he EU has focused on regulatory solutions, establishing principles that govern the use of data across multiple sectors. A core principle is the need for individuals' consent for certain data collection and processing activities. However, doubts have been expressed about the viability of this data control mechanisms in adequately protecting consumers' privacy (Acquisti et al., 2013; Solove, 2013; Zuiderveen Borgesius, 2015). The large opportunity costs associated with consumers reading privacy policies (McDonald and Cranor, 2008) and the fact that the same policy can nudge individuals to disclose varying amounts of personal data simply by manipulating the format in which the policy itself is presented to users (Adjerid et al., 2013), are indications that the protection offered by that control may be illusory. Cate & Mayer-Schonberger (2013) argue that informed consent is no longer a meaningful tool in a world of big data. Its application in practice quickly runs into high transaction costs for data subjects. Users click on these policies when prompted without further reflection. Ordinary websites can link to dozens of cookies from different data collection firms. Consumers give consent and are unlikely to be aware of the firms collecting their data, let alone the purposes for which they are collected and processed or how they are traded. Since data are non-rival many firms can use the same data for many different purposes. Reading the policy is too costly and does not provide an objective evaluation of potential consequences and costs. This does not mean that users do not value privacy; it only means that the value of privacy is estimated lower than the benefits of accepting the "consent" policy in ordinary circumstances. Users may still attach a very high value to privacy in exceptional crisis circumstances when an obvious misuse of private data occurs, with costly consequences. They will only be willing to invest in overcoming these costs in extreme cases when the stakes are very high. It may be that the value of private data is simply not that high, at least not from an individual consumer's perspective.

5.3. Firms' access to data: a competition perspective

There is also substantial data asymmetry between firms, or between firms and the platform which they use to market their products. However, opinions are divided as to whether this distorts competition between firms and would require intervention by competition authorities or regulars. Some competition researchers argue that data markets are active and offer many substitutable sources of data. In that view, data do not constitute and entrenched source of advantage for firms because they are non-rival, ubiquitous, potentially excludable but highly substitutable and have a very short economic lifespan. Others argue that if data are not traded they do not fall under competition law because there is no market in the first place. Still, data are valuable assets for some firms. The rapid increase in data driven mergers bears witness to that. These mergers are not only driven by cost savings; they may also be attempts to stop competitors form snooping up the data. US competition law does not offer much scope however to overcome refusals to trade non-substitutable data owned by a firm in a dominant market position. The remedies of antitrust, for instance forced data sharing, are perceived as disproportional and would constitute a disincentive to investment in data.EU law offers more scope to force access when data are an indispensable input for a new product that does not compete directly with the main product. Indispensability remains hard to prove however. Free services offered to one side of a platform are seen as pro-competitive and not harmful from an antitrust perspective. However, EU data protection authorities worry about the personal data collected by free services. Amidst all this discussion among data and competition researchers, there is a lack of jurisprudence. There are as yet no competition cases in the EU or in the US that are related to (the absence of) trade or market positions in data. Competition cases that could have touched upon this issue, such as the Facebook-Whatsapp and DoubleClick-Google mergers, were careful to avoid the perception that data could constitute a

competition problem. In the remainder of this section we present a more detailed literature review of these issues. Most of that literature takes a legal perspective, often referring to specific competition cases. There is very little economic analysis of this question.

Lambrecht & Tucker (2015) see no reasons why (big) data collection should lead to uncompetitive markets. They apply the classic "resourced based view of the firm" to address the question if big data provides a competitive advantage because it is inimitable, rare, valuable and non-substitutable. The authors apply the "3V" definition of big data: volume (bytes), variety (in variables and formats) and velocity (real time collection and analysis). Data have peculiar economic properties: they are non-rival and can be produced and distributed at near-zero marginal cost. As a result, there is a thriving data market with big players that amass massive volumes & variety of information (not only Google, Facebook, Amazon, Apple etc. but also pure data companies like Acxiom, Datalogix and Bluekai) as well as a myriad of smaller players that focus on niche markets (for instance most apps collect a wide range of personal data). Most of these data are actively traded and accessible to anybody willing to pay for it. As a result, there are often many substitutable sources to acquire data. The authors argue that even if some companies do not sell their data, there are often several substitutes for these data. Many examples show that having a large in-house dataset does not confer an entrenched advantage. Skype and Facebook are sitting on piles of social network data but Whatsapp, Snapchat and Instagram still managed to build up a powerful market position ex-nihilo and without having these data to start with. The value of data is often limited by regulatory, commercial and practical barriers to interoperability. Thousands of taxi companies had valuable but totally fragmented data. Lyft and Uber designed new taxi services that managed to overcome not only the integration problem but added trust and reputation information to it. Tinder had zero data to start with but built an online dating system that was much easier to use and very rapidly outcompeted many existing dating sites that had much more data and complex algorithms. More importantly, the size and unstructured nature of many big datasets make it difficult to establish causal relationships and extract truly actionable insights. Mere correlation limits the usefulness of data (Ioannidis, 2005) and may often lead to the wrong conclusions (Lewis et al, 2011, 2015; Pilaszy & Tikk, 2009; Goel et al, 2010; Varian, 2014). The authors conclude that neither of the four resource qualities applies to big data. The short history of the digital economy has so far shown that substitutes exist. Competitive advantage is not acquired by accumulating lots of data but rather by developing the organisational capabilities to make better use of data.

Tucker & Wellford (2014) also start from the "3V" definition of big data and examine this from a competition law perspective. They accept the view that data are ubiquitous and non-rival, widely available and traded, used by organisations of all sizes and their value depreciates rapidly. The authors then focus their attention on data that are not traded, for instance Facebook social graph data, Whatsapp data, Google search data, Netflix film streaming data, in-car data, etc. They argue that data that are not traded do not fall under competition law because there is no market for these data. Competitive concerns in that case should focus on the impact on downstream services markets. The fact that some market data are not traded has not prevented competitors from entering a services market. There are many social network sites, search engines, film streaming services and car manufacturers.

Graef et al (2015a) do not accept Tucker & Wellford's (2014) argument that non-traded data do not fall under competition law. They explore the legal options for redress under competition law in a number of court cases around refusal to trade unique and non-substitutable data owned by a firm in a dominant market position. A number of US cases (LiveUniverse vs MySpace, Trinko, Facebook vs Power Ventures) suggest little scope for redress under US jurisprudence. US courts insist on a pre-existing voluntary course of dealing and proof that the monopolist is willing to forgo profits in order to achieve an anti-competitive end. In the EU, Article 102 of the Treaty seems to offer

more scope when access seekers needs data as an input for a new product that does not directly compete with the main product produced by the data owner. The Magill, IMS Health and Microsoft cases provide some jurisprudence in that direction. The ECJ insist on four conditions: that the data is indispensable for the downstream product, that there would not be any effective competition between the upstream and downstream product, that refusal prevents the emergence of the second product, and there is no objective reason for the refusal. Indispensability remains hard to prove however in a world of ubiquitous and substitutable data.

Firms can of course use their data to strengthen their competitiveness in a market. Booking.com aggregates hotel booking data across many hotels and cities. That gives it a unique insight in the dynamics of the hotel market. That may generate market leverage over hotel price setting, extract higher margins and boost its revenue. However, there are many other hotel reservation sites that collect similar data and exhibit similar behaviour. Monopolistic competition is a feature of many markets that are not purely driven by price competition but also by differences in the quality and variety of services. The success of Booking.com in this market cannot be due only to its data collection; its commercial strategies and services will play a role. It is the task of competition authorities to watch that commercial behaviour and protect the interests of consumers. Tucker & Wellford (2014) conclude that "compelling firms to share the source of their advantage … may lessen the incentive for the monopolist and the rival to invest in those economically beneficial facilities".

Stucke & Grunes (2016) disagree with the optimistic view that ubiquitous and tradable data keep competition policy concerns at bay. They observe that data-driven mergers are rapidly increasing, driven by business concerns about data efficiency, related to the "3Vs", but sometimes also to stop emerging competitors from snooping up the market. They point out that not all data are publicly for sale and even if they are achieving interoperability can still be costly and slow to achieve. These costs can enable data firms to erect barriers to entry and maintain their market position by limiting their competitor's access to data or preventing others from sharing the data, opposing data portability policies (Strucke & Ezrachi, 2015). Mergers between complementary data firms can generate value through economies of scope and scale. Moreover, in a digital economy with multi-sided platforms these mergers can help to tilt the balance on one side of a platform and thereby trigger more growth on other sides. One side of a data platform is often offered for free simply to collect data that can be monetized on other sides. The stereotype example is Google Search but there are many examples of these commercial strategies. Mergers among data firms should therefore not only be looked at from a competition policy angle because they can interfere with privacy and data protection concerns.

Stucke & Grunes (2016) raise important questions about economies of scale and scope in datasets and how that affects vertical integration between firms holding complementary datasets. This was recently illustrated by acquisitions of map making companies by car manufacturers and Apple (names of companies?). Who can achieve the strongest economies of scope, an information company with ambitions to expand into automated driver systems or a car manufacturer with similar ambitions? This brings us back to the classic vertical integration question: assuming that the two firms hold complementary datasets, would it be better for the firms to merge or to trade their data as two autonomous firms? These are essentially empirical questions that depend on many factors and can only be answered on a case-by-case basis; there is no a-priori theoretical answer to this question. The question is further complicated by a multi-sided market environment where decisions are not taken in function of separate markets but the overall multi-sided market. Network effects and discriminatory pricing on several sides of the market can help a platform achieve growth.

Sokol & Comersford (2016) provide a comprehensive literature review on this subject. They point out that problems triggered by big data could be addressed through several

types of complementary remedies, including antitrust and consumer protection policy tools. Competition authorities in the EU and in the US have so far not found any competition problems related to big data. Case law does not support the contention that data collection is an antitrust problem. They refer to Ohlhausen & Okuliar (2015) who argue that the nature of the relationship between platform users and data collectors is more likely to fall within the realm of consumer protection law (including privacy and data protection law) than competition law. The authors accept the characteristics of data markets as described by Lambrecht & Tucker (2015): low entry barriers, non-rival, ubiquitous but potentially excludable, substitutable and short value life span. They add that online data have generated unprecedented consumer benefits in terms of free online services, improved quality of services and rapid innovation. The ability to offer free services via monetization of data sales and advertising is seen as a pro-competitive effect and not harmful from an antitrust perspective. The absence of monetization would reduce the volume and increase the cost of online services and reduce competition in product markets (Evans & Schmalensee, 2014). The authors underline that in the context of multi-sided platforms, any uncompetitive behaviour should be examined for the platform as a whole, not just for one side of the market. They point out that the empirical evidence about direct and indirect network effects in platforms and their alleged contribution to monopolistic market structures is not robust: the magnitude and sign of network effects is highly variable. Data driven mergers (Graef, 2015) whereby the acquirer wants to get access to the data of the target may not only have a market structure effect but also a positive efficiency effect in terms of economies of scale and scope.

Sokol & Comersford (2016) than turn to the question of privacy harm. Harm to privacy does not equal harm to competition. Following Acquisti et al (2015) they content that data collection and analytics provides substantial benefits to consumers. However, consumers may feel that they do not have control over the data collected and their use. Antitrust is ill-equipped to address that problem; privacy and data protection laws may be better instruments to address this. The remedies of antitrust, for instance forced sharing of data, would not be proportional to the problem and may actually harm competition because it would constitute a disincentive to invest in data acquisition and reduce the efficiency of data use and data analytics. The remedy itself may trigger privacy concerns because firms would be obliged to share data with others for which the user has not given consent.

We conclude from this literature review that opinions are very much divided on whether or not there are competition policy concerns in (big) data collection and the behaviour of data-driven firms. Competition case law on both sides of the Atlantic has not considered data to be a competition policy issue. Cases of refusal to trade data may stand a slightly better chance of being accepted under EU than under US jurisprudence. Authors who argue in favour of intervention have very little empirical support for their arguments. Whatever arguments about consumer harm because of data collection and use strategies may be better addressed through consumer protection legislation. Moreover, this harm should be carefully considered against the benefits that consumers derive from (big) data. The cure – restricting data collection & use and data mergers, and forcing access to privately owned data – may be worse than the harm.

5.4. Empowering the data regulators

In this section we turn to the regulators (national regulators in MS, EU regulators) and the asymmetric information situations that they are regularly confronted with in their supervisory role.

The EU Data Protection Supervisor (2014) called for more cooperation between competition, consumer protection and data protection authorities in order to get a better picture of data driven-activities in online platforms across these regulatory domains and

provide insights to the authorities. Regulators in each of these domains have intrusive investigation powers to overcome information gaps but this may not be sufficient in a digital age where platforms can harvest big datasets and construct complex algorithms to use these data to manage the interaction between the platform and its users. We argue that an institution equipped with specialist computing skills and infrastructure could more easily overcome this information asymmetry and would also be in a position to facilitate cooperation between existing competition, consumer and data protection authorities in the digital economy. The institutions could work under the auspices and the legal mandates of the already established competition, data protection and consumer protection authorities at EU and Member State level. The established authorities could delegate tasks in the framework of their mandate to the executive agency.

The proposed institution could contribute to that collaboration and support the existing authorities in at least three types of tasks:

- First, the agency could assist competition, consumer protection and data protection authorities in case-specific investigations. It could collect and analyse data related to the case and transmit its conclusions to the authorities. It would have the technical expertise and computing infrastructure to do large-scale data collection and analysis, covered by the legal mandates of the authorities. Established authorities often do not have (sufficient) in-house technical capacity for data-intensive case studies. This is particularly the case for big platforms where information collection, analytics, storage and use may be very complex and require considerable technical skills and computing infrastructure to analyse. Regulators have been given strong intrusive powers to access the data. However, understanding the data may be more difficult. Regulators frequently hire independent external experts to carry out specialised analytical tasks that require specific skills. In the case of large digital datasets it may be difficult to find external experts who have no conflicts of interest and have the technical expertise and computing infrastructure to carry out such data analysis. Datasets can be vast and not transferable on a computer disk. Algorithms that operate on top of these data can be large and complex. The analysis of the behaviour of these algorithms may require online behavioural experiments to be carried out in collaboration with the firm. This leaves a margin for moral hazard. To overcome this, at least in part, the investigating authority would need autonomous technical expertise.
- Second, it could monitor on a more permanent basis the activities of online platforms. Competition and data protection regulators work on a case-by-case approach. Several academics have argued in favour of regular supervision of data collection & analytics in large online platforms (Rieder, 2014, 2015; O'Reilly, 2012; Gillespie, 2010, 2014; Pasquale, 2010, 2015; Mayer-Schonberger, 2012; etc.). Pasquale (2015) argues that a case-by-case competition, data protection or privacy authority approach is not very efficient. It may take years to get the data and decide a case, long after the facts, while a permanent agency could readily observe behaviour and intervene much quicker and preventively. This could be compared to regulators in other sectors such as banking, telecoms and energy that monitor activity in their respective sectors on a regular basis, independent of specific cases. Permanent monitoring does not necessarily have to be as intrusive as standard competition and data protection investigations that can go far beyond the firewall in online platforms. Much monitoring can be done on an automated basis by means of robots that observe the data and behaviour of websites, regularly report on what they observe and produce synthetic reports. As online platforms gradually shift to app based services, this monitoring becomes somewhat more difficult however and may require collaboration with the platform provider to access activity data.
- Third, it could report on a regular basis to the existing competition, consumer and data protection authorities on platform compliance with existing legislation such as anti-discrimination laws, advertising rules, restrictions on health products and services, consumer protection legislation, etc. It can report on the collection, use

and trade in personal data in platforms, produce statistics on compliance with the GDPR and provide useful insights in compliance with consumer protection legislation. Currently little is known for instance on the operations of secondary data markets in the EU. The agency could also point to systemic risks that may emerge in data collection and trade. Traditional sectors in the economy often produce a wealth of statistics on a regular basis. The digital economy however suffers from a paradox: never before was so much information collected and never before was it so difficult to get access to that information because it is all privately held by commercial firms. The public policy benefits and insights from a comprehensive sector overview are missing. The executive agency could fill an important public information gap with regard to the digital economy. This could gradually ensure more policy coherence between regulators in their respective domains.

The new EU GDPR establishes a European Data Protection Board that will have authority on personal data protection matters with an EU-wide impact. This Board will have a Secretariat that will fulfil administrative and coordination duties. The Board might constitute a good anchor point for an institution with technical expertise and computing infrastructure to handle large data inquiries on a more permanent basis.

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As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

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Stimulating innovation
Supporting legislation