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Digital Platforms as Information Aggregators: Implications for their Design and Regulation

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Abstract

In this paper, I focus on the existing empirical literature and its gaps to highlight the benefits and risks of digital platforms' role as information aggregators. On the positive side, this information can be used to improve existing consumer protection regulation. On the negative side, platforms can use their information to entrench their dominant positions and capture ever-increasing value.

Digital platforms are information aggregators. Amazon collects information on who wants to buy and who wants to sell thousands of goods. Airbnb knows who's looking for accommodations and who is available to host across thousands of locations. Facebook collects user-generated content to share with other users and to help advertisers identify potential customers. Digital platforms' main role is to aggregate, repackage, and efficiently redistribute this information so that users can engage in valuable exchanges.

The value of information tends to increase with the number of users who provide the precious input. Take Uber as an example. Knowing that somebody is requesting a ride from Central Park in New York is valueless unless it can be matched to the knowledge that a driver is nearby and available to pick up that passenger. Thus, information and its intrinsic scale economies give digital platforms incredible power to create value for their users and capture value for themselves. Yet value capture, especially when originating from abuses of market power, has raised scrutiny in recent years, with Europe passing major legislation[1] and the United States starting legal proceedings against the major tech giants.[2]

In this article, I use existing research and open questions to argue that platforms' role of information aggregators is a double-edged sword when it comes to regulation: it can help regulators protect consumers in ways that were previously unavailable, but it also creates new challenges for consumer protection that the regulator needs to consider.[3] After introducing existing research on how platforms collect, aggregate, and disclose information in Section 1, I discuss existing academic work from two main angles. In Section 2, I present research showcasing how that information can be used to improve consumer protection (what I refer to as *regulation with platforms*. In Section 3, I focus on work investigating key regulatory challenges when this information is managed by platforms whose objectives may be at odds with those of its users or the broader society (*regulation of platforms*. The two sections make exposition easier

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[1]The Digital Markets Act and the Digital Services Act (https://digital-strategy.ec.europa.eu/en/policies/digital-services-act-package) were passed in Europe in 2022, and implemented in 2023.

[2]See for example https://www.justice.gov/opa/pr/justice-department-sues-google-monopolizing-digital-advertising-technologies, https://www.ftc.gov/news-events/news/press-releases/2023/09/ftc-sues-amazon-illegally-maintaining-monopoly-power, and https://www.justice.gov/opa/pr/justice-department-sues-apple-monopolizing-smartphone-markets.

[3]At least four other papers offer useful reviews of digital platforms and the related literature, although from different angles: Banerjee et al. (2024), Cheng et al. (2024), Jullien et al. (2021), and Rysman (2009).

but I recognize that the boundaries between the two angles are often blurred. Although there is ample theoretical research, the empirical literature remains scarce, at least in part because companies resist collaborating on research questions with potential regulatory risks. I will thus focus on the existing empirical literature and its gaps, which offer promising areas for future research.

1. Digital Platforms as Information Aggregators

The fundamental characteristic of digital platforms is that they collect, aggregate, and disclose information that can be used to create valuable exchanges between many user groups. For example, Google indexes the entire Internet to provide relevant results to users' queries. In turn, knowing what people search online is useful to advertisers who want to reach targeted audiences. But, as more broadly recognized in Kamenica and Gentzkow (2011), the type of information platforms collect, how they aggregate it, and the ways in which they disclose it back to their users have important consequences on the number and quality of interactions. The three steps (collection, aggregation, disclosure of information) are intimately related, but for ease of exposition, I will discuss each of them individually.

At the information gathering stage, it is well understood that platforms need to design mechanisms to collect truthful and complete information. Airbnb realized the costs of not accurately tracking host availability when Fradkin (2017) found that travelers' inquiries to book accommodations were rejected 42% of the times, in some part due to inaccurate hosts' calendars. Rejections, he found, were very costly to travelers, other hosts, and the platform itself, since receiving a rejection would substantially decrease a potential guest's eventual reservation.

Yet, simply asking for information from a platform's users may not be the right solution. Despite short-run benefits from asking for providers' availability (Horton, 2019), providers on a freelancer platform quickly learn they face no direct harms from always claiming full availability and rejecting requests ex-post. Filippas et al. (2023) find that a way for providers to internalize the negative externalities they impose on the rest of the ecosystem is by making them pay to disclose that they are available to start new jobs.

The need for incentive-compatible designs to collect information from users also applies to consumer reviews. Resnick and Zeckhauser (2002) were among the first to identify the pitfalls of reciprocal feedback mechanisms on eBay. In the past, when both buyers and sellers rated each other, mutual ratings were highly correlated, suggesting a high degree of reciprocity (when the first submitted review was positive) and retaliation (when the first review was negative). Sometimes, when rating one side of the market is unnecessary, the solution to this problem is asymmetric rating systems (as is now on eBay, where only buyers rate sellers); other times, when rating both sides of an exchange remains important, a partial solution is to keep the rating hidden until both parties have submitted their reviews or the time to review has elapsed (as on Airbnb).

Not all platforms need to collect the same type of information; determining transaction prices is a prime example (Farronato, 2018). In some contexts, like Uber, platforms offer a price and effectively collect acceptances or rejections by drivers and passengers, which inform future pricing decisions. In other contexts, like Airbnb or Amazon, platforms collect pricing choices from sellers, sometimes with platform suggestions based on knowledge of demand. In yet other contexts, like eBay or targeted advertising on Google, platforms let buyers bid for items they want. Finally, on platforms like Upwork, the needs of individual buyers can be so idiosyncratic and the skills of freelancers so heterogeneous that one-on-one bargaining is the best solution to determine prices, which the platforms only collect ex-post.

After information gathering, the second step requires platforms to put significant effort in aggregating information efficiently. For example, people would not use Amazon if it collected products' pricing, delivery speeds, and ratings, but then would display products in a random order in search results. Similarly, Uber would be much less popular if it collected passengers and drivers' locations, and then let them figure out how to match with each other.

Ranking, recommendations, and matching algorithms play a pivotal role in aggregating information. The evidence on the steering effects of ranking and recommendation systems is large. Ghose et al. (2014) offer one of the earliest analyses of the effect of ranking algorithms on consumer choices in

the context of Travelocity. More recently, Ursu (2018) uses experimental variation from Expedia to confirm that ranking effects are strong, but not as strong as observational data would suggest, and Fong et al. (2024) explore the mechanisms behind these ranking effects. When it comes to recommendations, Aguiar and Waldfogel (2021) measure the large effects of Spotify's decision to add or drop songs from its platform-operated playlists. Similarly, Lei et al. (Forthcoming), Fang et al. (2024), and Zheng et al. (2023) identify recommendations as key drivers of customer attention in online search, e-commerce, and food delivery, respectively.

Yet, recommendations can sometimes be ineffective at steering platform users in the intended direction. If users mistrust the platform and its algorithms, users may end up rejecting algorithmic recommendations, even if they would have benefited from them. This is particularly true in ride-sharing, where research has shown drivers rejecting profitable payment schedules (Angrist et al., 2021) or positioning recommendations (Liu et al., 2023).

When alternatives are fairly substitutable, as in ride-sharing, instead of ranking or recommending, platforms send take-it-or-leave-it offers created by a centralized matching algorithm to reduce search costs. The parameters of those algorithms, such as whether they are one-to-many or many-to-many matching algorithms, can have profound implications on the number and quality of matches (Farronato et al., 2018).

By affecting matches, algorithms indirectly impact the characteristics of products and services that can be exchanged on the platform. This is especially evident in Dinerstein et al. (2018). The authors estimate that a ranking algorithm that prioritizes low prices heightens price competition among sellers on eBay. This has positive downstream effects on consumers, who then buy at higher rates and lower prices.

The current frontier of research is focused on identifying the risks and benefits of personalization in rankings and recommendations. On one hand, personalized offerings can better tailor the individual preferences of each user (Sun et al., 2024). On the other hand, personalized offerings risk reducing healthy competition among sellers. Kaye (2024) explores the personalization-competition trade-off on Expedia, and finds that failing to take into account pricing adjustments would lead to large overestimates of consumer welfare benefits from ranking personalization. Algorithmic discrimination is another risk. Cowgill and Tucker (2019) provide an economic-based discussion of algorithmic fairness and identify the key sources of bias in algorithms, including unrepresentative training data and user composition, the latter of which is empirically investigated in Lambrecht and Tucker (2019).

The final step is information disclosure, i.e., which pieces of information platforms should disclose, and how. In a world without search costs, as long as the information is available, it should not matter how exactly it is disclosed. Yet, the previous paragraphs and ample work identifying significant search costs (Santos et al. (2012) for example) have emphasized that consumers are steered towards options that are more easily available. By the same token, the information disclosed on each of those options should affect what consumers ultimately choose.

When it comes to disclosing quality, online reviews and badges have received particular attention. A key measure of quality comes from consumer ratings. The way consumer ratings are disclosed can have major effects on the market, with both theoretical (Vellodi, 2018) and empirical (Dai et al., 2018) work demonstrating this. Because quality can be highly heterogeneous across online service providers, and because online reviews alone are easily manipulable (Mayzlin et al., 2014) and can be uninformative about the true underlying quality (Nosko & Tadelis, 2015), many platforms have created badges to identify high-quality providers. Amazon has a Best Seller badge, eBay has Top Rated Sellers, Airbnb has Superhosts. Badges have been shown to affect sellers' incentives to offer high quality products and the prices they charge (Hui, Saeedi, et al., 2023). Because platforms can display multiple badges and those badges can be based on a number of performance metrics, researchers have also explored the effect of increasing the number of certification tiers (Hui, Liu, & Zhang, 2023) and the effects of basing badges on consumer feedback versus administrative metrics directly collected by the platform (Hui et al., 2024).

Another crucial piece of information that platforms disclose is price. Platforms notoriously have several pricing add-ons, from commissions to shipping fees to sales taxes. Ellison and Ellison (2009)

demonstrate how sellers have strong incentives to obfuscate prices by listing their lowest-quality product on price comparison websites to attract customers, and then offering upgrades at prices that are only disclosed once a consumer is on the seller's website. If platforms earn revenues that are proportional to total spending, then the platform itself has a strong incentive to make more expensive options look cheaper than they are. Indeed, Blake et al. (2021) find that platform-wide price-obfuscation strategies make price comparisons difficult, which leads consumers to spend more than they would otherwise.

When platform users submit requests to be matched (e.g., job seekers submitting applications to a job listing; consumers submitting requests to work with freelancers), the decision of whether to disclose information about competing requests has practical consequences on which requests are ultimately submitted. The fundamental trade-off is the following: on one hand, many other submissions signal high quality; on the other, many other submissions imply a lower likelihood of being selected. Fradkin et al. (2023) explore this trade-off directly on the now-defunct Facebook job platform, and finds that the second effect dominates: disclosing the number of previous applications to a job listing redirects applications towards vacancies with fewer previous applications, ultimately increasing application rates.

There exists a lot of information that platforms do not disclose, or make it hard to access (one case is price add-ons, as described above). For example, consumers often rate services on several dimensions of quality. On Airbnb in particular, consumers are asked to rate a stay on the basis of six dimensions, including cleanliness, communication, and location. Yet in search results, the platform discloses only the overall rating, a compound metric of the separate quality dimensions. Another example includes return rates on e-commerce platforms, which are rarely available. Amazon has only recently started showing a warning for products that are often returned.[4] Although it is possible that too much information can actually lead to cognitive overload, research has mostly focused on the benefits of including information to motivate sellers and allow consumers to make better decisions.

1.1. Directions for Future Research

From the above list of existing work, one may understandably conclude that there is already a lot of research on the effects of improving information design at the collection, aggregation, and disclosure stages. Despite this, I think there are at least five areas where new research can expand our existing knowledge. First, existing research seems to focus on platform interventions with positive effects on platform users and the platform itself. Yet, there is no reason to believe that all platform's interventions are positive. For example, Dai and Luca (2020) show that posting restaurant hygiene scores from government inspections on Yelp.com can be helpful for consumers, but mostly if the information is made more salient on the webpage. The selection bias towards positive interventions is likely driven by at least two reasons. One reason is platforms' incentives: when companies collaborate on academic research, they are more likely to share data on strategies that have had a positive effect. The other reason relates to the fact that it is still rare for peer-reviewed journals to publish null results. Yet, understanding why some information is unnecessary to collect or disclose can have as valuable of an effect on platforms' strategies (for example, on cost savings) as knowing that other types of information are very valuable.

Second, existing work tends to focus on measuring the effects of one intervention at a time. This results from existing A/B testing approaches that focus on individual product tweaks while holding everything else constant. Such an approach would be adequate in contexts where each intervention is additively separable. On platforms though, there are often complex interactions, substitutabilities, and complementarities between the collection, aggregation, and disclosure of information that deserve academic attention. For example, the effect of assigning higher weight to price in search ranking algorithms while adding a "Lowest Price" badge to products is unlikely to be the sum of the two individual effects. When the number of product tweaks increases, testing each potential combination becomes prohibitive. More research is needed to identify these interactions and create experimental designs that do not become impossible to implement given the combinatorial nature of such interactions. Similarly,

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[4]https://www.theverge.com/2023/3/28/23659868/amazon-returns-warning-product-reviews-tag-feature.

because platforms can, in principle, disclose an almost infinite amount of information, but consumers face search costs and limited attention, how should a platform prioritize information disclosure? An important area of inquiry of this topic includes identifying when platforms should control or standardize information disclosure from service providers (which makes product comparison easier), and when instead they should allow providers to decide what to disclose (which allows for more heterogeneity in product offerings).

Third, a large number of papers described in this section typically leverage short-run experimental variation in access to information, such as variation in rankings or recommendations. A key challenge with this experimental approach is dealing with violations of the stable unit treatment value assumption (or interference between treatment and control units) and equilibrium adjustments. Holtz et al. (2025) partnered with Airbnb to show that at least 20% of the estimated treatment effect magnitudes are due to interference, and Johari et al. (2022) identified market balance between different user groups as a factor influencing the estimate bias. More effort is needed, perhaps with a combination of experiments, simulations, and counterfactual analyses (Fradkin, 2019), to obtain unbiased estimates of the effects of interest.

Fourth, research has mostly focused on platform designs that can be easily summarized in numbers (e.g., prices, number of reviews, and average ratings). Advances in machine vision and generative AI offer new ways in which visual and textual information can be aggregated and summarized for consumption by platform users. For example, buyers rarely read through the entire text of every product review ever submitted. Recently, platforms have started providing AI-generated summaries of reviews. While there are strong reasons to believe this will improve the quality of exchanges, there is not yet a lot of research showing the average and distributional effects of such changes.

Fifth, the recent scrutiny over the market power of platforms has raised the level of mistrust that users have for the platforms they use. This creates a dilemma for algorithms to make recommendations to platform users: are users rejecting recommendations because it is in their best interest to do so, or are they rejecting them because they do not trust the platform? Disentangling the two drivers of consumer choice will become increasingly important in a world where the deployment of algorithms changes the data that are then fed into new iterations of those same algorithms (Sühr et al., 2024). It will also be important to understand and design mechanisms to regain the trust of platform users, so that truthful information can be collected for the efficient working of the ecosystem. One potential source of mistrust is that consumers are often unaware of how rankings and recommendations are determined. An important area of exploration is on the effects of increased transparency in these algorithms on users' interactions with platforms.

Although empirical research on information design can be inherently fragmented and case-based, which limits the generalizability of the results, there remains ample opportunities to learn broadly applicable patterns. To this end, it is the responsibility of researchers to identify general questions and have a clear understanding, ideally backed by empirical tests, of where and why the answers can be applied.

2. Regulation With Digital Platforms

Despite a few exceptions, several digital platforms have entered pre-existing markets, which are already governed by established regulations. Consider the example of ride-sharing services like Uber and Lyft competing with traditional taxi drivers, who must possess medallions to operate legally. Similarly, Airbnb competes with hotels, which are subject to stringent health and safety inspections to ensure that the food they serve and the facilities they maintain do not pose a risk to consumers. These regulations, which encompass occupational licensing, certification, and health and safety inspections, are primarily designed to address a significant market failure: asymmetric information.

Asymmetric information arises when buyers cannot effectively distinguish between high- and low-quality products or services, leading to a potential market breakdown where only inferior goods are traded or, even worse, no trades take place at all (Akerlof, 1970). To mitigate this issue, regulations have

been implemented across various industries to increase consumer trust in suppliers, thereby enhancing demand. However, these regulations also impose costs on suppliers, acting as barriers to entry or increasing marginal costs, which, in turn, may reduce competition and increase prices.

Given that such regulations already exist, it is conceivable to extend them to online service providers. For instance, safety and accessibility regulations applicable to hotels could be extended to hosts on Airbnb, or taxi medallion requirements could be applied to Uber and Lyft drivers. However, merely applying existing regulations to new digital platforms raises several critical questions. First, is the existing regulation still justified? Many consumer protection laws were enacted decades ago when consumers had less access to alternative sources of information about service providers. In the current era of online reputation systems, do we still need such regulations? Second, should fundamentally different supply models be forced into the same regulatory framework as traditional, more dedicated forms of supply? Finally, do digital platforms offer alternative solutions for addressing asymmetric information? These questions necessitate a closer examination of the relevance and adaptability of existing regulations in the digital age.

The main policy question concerning consumer protection is whether existing regulation should be extended to providers on digital platforms. For many contexts, such as doctors or lawyers, occupational licensing regulation seems an obvious constraint to be extended to the digital world. For others however, such as taxi drivers, it is not obvious ex ante whether the benefits outweigh the costs. In principle, a well-functioning online reputation mechanism can reduce the need for upfront screening or quality certification (Friedman, 1962; Shapiro, 1986). The first step to evaluate whether such an alternative is feasible is to understand whether consumers perceive signals provided by government regulation and online reviews as informative about the quality that they care about. Farronato, Fradkin, Larsen, and Brynjolfsson (2024) examine the role of occupational licensing and online reviews for home improvement services in the United States. By analyzing data from an online platform, my co-authors and I could assess whether platform-verified licensing credentials influence consumer choice. We found that while consumers consider online reviews when choosing whom to hire, the signaling value of licensing credentials is negligible. This result does not imply that occupational licensing is unnecessary for home improvement. Indeed, it may still be possible for occupational licensing to raise service quality, even if consumers do not distinguish between professionals with and without verified licensing credentials. The challenge to answering this question is having access to objective measures of service quality. Athey et al. (2024) overcome this challenge by focusing on the ride-sharing market, where telemetry measures allow for the recording of speed, acceleration, braking, and phone handling. The authors find that Uber drivers provide better service quality than taxi drivers. Quality seems to be driven, at least in part, by drivers' responsiveness to consumer preferences, access to information about their own driving performance, and platform incentives rewarding quality.

Existing regulations are typically designed for professional providers, leading to the emergence of what can be termed "dedicated supply" (Einav et al., 2016). For example, hotel owners and taxi drivers are likely to operate their businesses full-time to justify the costs of compliance with licensing regulations, certifications, and ongoing inspections. However, this can result in a mismatch between supply, which is fixed, and demand, which can be highly volatile as a function of rush hours (for taxis) and holidays (for hotels). Digital platforms have introduced a new form of flexible supply that can respond dynamically to demand fluctuations (Cullen & Farronato, 2021). This flexibility generates significant welfare benefits for consumers, expanding choice and reducing prices during high-demand periods. Farronato and Fradkin (2022) estimate large consumer gains from the entry of Airbnb, because short-term rental platforms expand room supply when it is most needed, such as in New York on New Year's Eve when hotels are fully booked and prices are sky-high. However, the introduction of such flexible supply raises questions about how to adapt consumer protection regulations while ensuring fair competition between full-time and occasional service providers. Some cities have begun experimenting with mixed regulatory frameworks that distinguish between flexible and dedicated supply. For instance, home-sharing hosts might face fewer restrictions than hotels but are limited in the number of nights they can rent out their properties. Similarly, ride-sharing drivers might be subject to fewer regulations

than taxi drivers but are restricted in where they can pick up and drop off passengers. These approaches represent early attempts to harmonize traditional and digital supply models within a fair regulatory environment.

Another critical question is whether digital platforms can offer alternative methods for addressing asymmetric information. Traditional regulation relies on expert evaluations of provider quality, such as health and safety inspections for restaurants. To what extent can online reputation systems, such as Yelp reviews, serve as a partial substitute for traditional regulatory mechanisms? The answer largely depends on whether consumers can fully observe quality in the short term and whether providers might prioritize meeting consumer demand at the expense of other (unobserved or long-term) service quality. For example, Y. Chen and Lee (2024) demonstrate that, while Yelp reviews primarily focus on physician's interpersonal skills, ratings are also positively correlated with various measures of clinical quality. Similarly in the context of New York City's restaurants, Farronato and Zervas (2022) show that online reviews do contain valuable information about restaurant hygiene, influencing consumer demand away from poorly rated establishments and incentivizing restaurants to be cleaner. However, we also find that online reviews are unable to capture all aspects of hygiene that are important for consumer safety, leaving ample room for government intervention.

Finally, consumer protection includes protection against discrimination, for which a number of studies have identified some problematic behavior and some causes for optimism. On one hand, C. T. Lam et al. (2021) find that Uber increases equality in access to rides. On the other hand, Edelman et al. (2017) find that requests for accommodations by guests with distinctively African-American names are significantly less likely to be accepted than requests by guests with distinctively white names. Chan (2023) finds similar discriminatory behavior by customers towards service providers, in this case African-American and Asian doctors. Despite the discriminatory behavior, existing research highlights how digital platforms have a unique opportunity to reduce discrimination, by virtue of the information they gather about consumer and providers' quality. For example, Chan (2023) finds that providing information about doctor quality can reduce discrimination online by 90%.

The tension highlighted for discrimination applies more broadly to other critical societal challenges, including hate speech and fake news, pornography and human trafficking, and counterfeits. On one hand, platforms like Facebook, Telegram, and eBay have greatly reduced the costs of generating and distributing this type of content. On the other, the digital traces that this content creates can be used, under effective platform-government collaboration, to identify, remove, and (when needed) prosecute perpetrators. The empirical evidence so far is quite pessimistic, showing that removing such content from one platform quickly shifts activity to competitors, often outside of national boundaries (Zeng et al., 2022). And if that does not happen, government and platform objectives may be misaligned (Beknazar-Yuzbashev et al., 2022), or other human rights, such as free speech, may create conflicts that are difficult to resolve (Van Alstyne et al., 2023). These issues are squarely at the intersection of regulation *with* and regulation *of* platforms, so I present a broader discussion in Section 3.

2.1. Directions for Future Research

As digital platforms continue to reshape traditional markets, the need to reevaluate and adapt existing regulatory frameworks targeted at protecting consumers from risky transactions becomes increasingly important. Although many of the existing regulations are still likely justified today, others may need to be reformed or replaced to accommodate the unique characteristics of digital supply models and the opportunities offered by online monitoring of quality provision. The wealth of data generated by online platforms offers new opportunities to enhance consumer protection, either by complementing or substituting traditional regulatory mechanisms. Current research has merely scratched the surface of these crucial questions, leaving numerous areas ripe for further academic exploration. The biggest difficulty in answering these questions stems from the need to combine regulatory data with platform information.

One area is improving our understanding of regulatory effectiveness. Digital traces give researchers new opportunities to study the costs and benefits of traditional regulation (Jin et al., 2022). Indeed, micro-level transactions and pricing data offer information on market outcomes that were previously unavailable. For example, occupational licensing has been the subject of substantial academic investigation in recent years (Kleiner, 2000; Kleiner & Soltas, 2023), but it has been difficult to disentangle the effects of regulation on demand (which may increase because of higher quality) versus supply (which may decrease because of higher entry barriers). Digital platforms allow academics to study traditional questions like occupational licensing with a fresh perspective. Detailed data on job requests, transactions, and prices can help researchers better separate the factors behind aggregate effects (Farronato, Fradkin, Larsen, & Brynjolfsson, 2024).

Because regulation often entails a complex set of requirements (e.g., education, on-the-job training, exams), a challenge lies in identifying which regulatory requirements provide the greatest net benefit in terms of quality without overly restricting competition or consumer choice. For example, is it better to require professionals to take one extra year of school education or one additional year of on-the-job training? These requirements vary greatly across states and occupations,[5] so researchers can help answer questions of this type.

An additional area of investigation is the interplay between government regulation and platforms' rules. Just like public institutions, digital platforms want to protect consumers from risky transactions, because the problems of asymmetric information apply to their ecosystems as much as to the broader society. If people did not trust online providers, the business of digital platforms would not survive. This raises important questions about how to effectively combine online monitoring with traditional regulations to enhance consumer protection. For example, can digital platforms be leveraged for enforcing regulation, such as when Glaeser et al. (2016) propose using online reviews to improve health and safety inspections of restaurants? Do platform-managed quality badges complement or substitute traditional certifications? By leveraging digital platforms, regulators may achieve the same or even higher quality outcomes with less effort, or they may refocus expert resources where they are most needed.

Finally, it is important to remember that although consumers and providers increasingly use online sources to find each other, there remains substantial economic activity generated through word of mouth and other offline approaches. Therefore, it is possible for online monitoring (or lack thereof) to induce different distributions of service quality and consumer risks offline compared to online, thus requiring fundamentally different regulatory approaches. For example, little is known about the relative prevalence of discriminatory practices online versus offline. How online and offline competition shape incentives for service quality and the need for regulatory intervention is a valuable avenue for future research.

3. Regulation of Digital Platforms

The previous sections have focused on ways in which platforms create value by collecting data and reducing information asymmetries. In this section, I discuss how the value is distributed among platform participants and outsiders alike. The critical force at play is the trade-off between scale and market power. Unlike more traditional businesses, digital platforms are characterized by unique economic features, including near-zero marginal and distribution costs, strong economies of scale and scope, increasing marginal returns to data, and powerful network effects.[6] The combination of these features leads to big platforms getting bigger, increasing market concentration and entry barriers. As platforms become dominant, they have strong incentives to use their profits to increase and maintain their market power (Hovenkamp & Scott Morton, 2020), and to capture a large share of the value created at the expense of platform users (who have few to no other alternatives to turn to) and the broader economy. These forces

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[5]For example, plumbers face very different regulations across U.S. states, with some states requirements several years of education, others focusing relatively more on on-the-job training, and yet others requiring minimal experience (Farronato, Fradkin, Larsen, & Brynjolfsson, 2024).

[6]See Stigler Committee on Digital Platforms, Final Report, available at https://www.chicagobooth.edu/research/stigler/news-and-media/committee-on-digital-platforms-final-report.

require a careful analysis of the benefits and costs of scale, and regulatory intervention when the costs outweigh the benefits.

In what follows, I focus on five key dimensions that require careful scrutiny, and where research has started providing some answers. The first three include externalities to agents outside of the platform economy, labor conditions, and consumer privacy. The fourth set of challenges arise from platforms that collect and redistribute user generated content, which raises concerns around addiction, echo chambers, and political polarization. The fifth and final issue is antitrust, to which I devote Subsection 3.1 given recent regulatory shifts. The empirical evidence on these critical questions remains limited, and often requires multi-disciplinary academic collaborations, which I discuss in Subsection 3.2.

I start with externalities. The growth of many digital platforms has led to the re-allocation of assets and people away from traditional uses and jobs, which can have profound effects on adjacent markets. Researchers have been interested in understanding the effects of platform entry on these neighboring markets, especially markets related to basic necessities such as housing. Barron et al. (2021) were among the first to study the effect of home-sharing on the housing market, finding increases in rental and sale prices due to the entry of Airbnb. The effect, Calder-Wang (2021) finds, seems to be concentrated in high-income white neighborhoods. On the positive side, Alyakoob and Rahman (2022) find that restaurants and their employees benefit from the increased demand brought by Airbnb travelers. Yet, if neighborhood amenities start shifting to cater towards tourists, local residents may be affected as a result. For example, residents may have access to more restaurants but fewer daycares when more travelers use Airbnb (Almagro & Domínguez-Iino, 2024), or may face increased congestion and reduced resources for public transportation when use of ride-sharing increases (Diao et al., 2021).

Digital platforms also raise questions related to labor protection. Although virtually all digital platforms attract providers who work as independent contractors or freelancers, platforms have received scrutiny over their level of control over these providers (especially when it comes to setting prices) relative to the lack of benefits, such as health insurance or paid leave. On one hand, providers have full discretion over their work schedule. The discretion has clear upsides, allowing gig workers to adjust their schedules in response to losses of other sources of earnings or sudden increases in consumption (Garin et al., 2020; D. Koustas, 2018; D. K. Koustas, 2019). The benefits are particularly concentrated among those who want flexibility in their working schedule, a rare characteristic among jobs requiring less education (M. K. Chen et al., 2019; Fisher, 2024b; Hall & Krueger, 2018). On the other hand, providers assume the majority of the risks associated with delivering the service, and are compensated only when they complete transactions, which has raised criticism and calls for strengthening protection of gig workers. It is unclear whether the earnings of gig workers make up for the higher risks. Both Hall and Krueger (2018) and Hall et al. (2023) find empirical support for earnings on Uber to be anchored by an outside option. Their evidence shows that even when Uber increases drivers' fee per ride, their utilization adjusts to keep hourly earnings constant. Because the prevalence of these alternative work arrangements is growing over time (Mas & Pallais, 2020), understanding how to effectively regulate them will become increasingly more important, not just in the short but also in the long run. Indeed, the shift towards gig work impacts human capital accumulation and career progressions, and Jackson (2022) finds concerning evidence that gig work reduces the incentives to move back to traditional wage jobs, with permanent effects on income and earnings.

Digital platforms collect large amounts of consumer data, so a key dimension of regulation that has been the focus of empirical research is data privacy. Results on the value of data to identify consumer preferences are mixed. On one hand, third-party data from data brokers seem to perform poorly at the task they are designed to complete, such as predicting user demographics for ad targeting (Neumann et al., 2019). Even worse, they may exacerbate existing societal inequalities by offering different degrees of prediction performance across different demographic groups (Neumann et al., 2024), leading to what Tucker (2023) calls *algorithmic exclusion.* Additionally, the limited number of papers that explicitly estimate returns to data show small and decreasing returns (Allcott, Castillo, et al., 2024; Bajari et al., 2019).

On the other hand, a host of empirical work highlights the value of data, especially first-party data. Sun et al. (2024), for example, conduct a large-scale field experiment to quantify the losses stemming from platform's inability to use personal consumer data for product recommendations. Their results emphasize the unequal distribution of such losses, which concentrate on niche sellers and consumers who would otherwise benefit the most from e-commerce. Similar positive values of personal data have been found in news consumption by Peukert et al. (2024) and advertising effectiveness by Goldfarb and Tucker (2011), although Tadelis et al. (2023) emphasize that there remains wide dispersion in the distribution of those benefits. Given the value that data provide to companies (Wernerfelt et al., 2024), it is not surprising that studies looking at the effect of the European Union's General Data Protection Regulation (GDPR) have found that privacy regulation tends to hurt firms' performance and innovation, limits competition and increases market concentration (G. Johnson, 2022; G. A. Johnson et al., 2023; Peukert et al., 2022).

When it comes to consumer preferences for privacy, individuals often claim to value privacy (Acquisti et al., 2013), which would justify recent legislation, including from the European Union and California, to limit the collection of consumer data and to ask for explicit consent from consumers. In practice, very few consumers end up making choices consistent with their stated preferences (G. A. Johnson et al., 2020), perhaps because of the way in which digital platforms structure the choices available to consumers (Farronato, Fradkin, & Lin, 2024; Lin & Strulov-Shlain, 2024). It seems apparent however, that GDPR has improved consumer awareness about firms' data practices and increased users' perceived control over their own data (see G. Johnson (2022) for an overview of the literature on GDPR).

It is worth emphasizing that in a regulatory vacuum, large platforms often end up setting privacy rules that may be convenient to their own objectives. The most famous example is the Apple's App Tracking Transparency feature,[7] which requires users' explicit consent before an app can track users across other apps on iOS. While portrayed as a way for consumers to take back control of their data, the feature also allows Apple to be the sole player with cross-app user data, a significant advantage in the data economy. It is thus no surprise that in summer 2024, Google abandoned Privacy Sandbox, its plan to eliminate third-party cookies in favor of a more centralized approach to consumer tracking on the Chrome browser.[8]

Content platforms pose a distinct set of challenges. Facebook, YouTube, and TikTok collect extensive user-generated content, and under Section 230 of the 1996 Communications Decency Act are not required to moderate it.[9] Section 230 is widely regarded as the factor most contributing to the growth of the Internet in its early years. Recently however, critics highlight that platforms allow for many illicit activities or toxic content to spread while retaining the freedom to moderate (and monetize) content with no transparency or accountability.[10] Beknazar-Yuzbashev et al., 2022 study the critical incentive misalignment: content that is toxic drives user engagement, creating a wedge between the goal of minimizing toxicity and maximizing engagement. The latter is often achieved by taking advantage of consumer biases, such as addiction (Allcott et al., 2022) or fear of missing out (Bursztyn et al., 2023).

There is widespread concern that content platforms create echo chambers and increase political polarization. The evidence, including by Levy (2021) and González-Bailón et al. (2023), confirms that echo chambers exist on social media, where users tend to be exposed to news that are aligned with their political beliefs. This exposure is both a function of platforms' algorithms exposing users to like-minded content, and users' choices to subscribe and engage with such content. Yet, this content segregation may just be a symptom, rather than a cause, of political polarization. Recent studies on the 2020 U.S. elections show that temporarily removing Facebook access (Allcott, Gentzkow, et al., 2024) or reducing the exposure to like-minded content (Nyhan et al., 2023) had zero effects on polarization, ideology, and voter behavior.

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[7]https://www.vox.com/recode/23045136/apple-app-tracking-transparency-privacy-ads.
[8]https://thehackernews.com/2024/07/google-abandons-plan-to-phase-out-third.html.
[9]https://www.pbs.org/newshour/politics/what-you-should-know-about-section-230-the-rule-that-shaped-todays-internet.
[10]https://www.justice.gov/archives/ag/department-justice-s-review-section-230-communications-decency-act-1996.

3.1. Antitrust

In recent years, antitrust regulation and its enforcement have emerged as critical issues. These concerns are especially pronounced in Europe but are also gaining traction in the United States, where regulators and policymakers are increasingly focused on the sustained market power held by a few major technology companies.[11] These companies, having established dominant positions in their respective markets, now pose a unique challenge: the potential abuse of their market power to entrench their dominance, stifling competition and innovation in ways that may not align with broader economic efficiency.

It is worth emphasizing an important distinction when it comes to antitrust. Antitrust *regulation* can be understood as an ex ante system of rules designed to prevent anti-competitive behaviors before they occur. This proactive approach focuses on setting clear guidelines and obligations that firms must follow to ensure markets remain fair and competitive. Examples include rules that require data sharing, limit exclusive dealing arrangements, or enforce transparency in pricing and algorithms. In contrast, *enforcement* operates ex post, addressing anti-competitive conduct after it has occurred. This typically involves investigating violations of antitrust laws and imposing penalties or remedies, such as breaking up firms or mandating behavioral changes.

While distinct, regulation and enforcement are deeply interconnected. Many enforcement actions take on quasi-regulatory characteristics, particularly when remedies involve ongoing obligations rather than one-time penalties. For instance, interconnection requirements or mandated access to essential facilities often emerge from enforcement actions but function like regulatory rules to shape future market behavior. Similarly, merger control, though classified as enforcement, often resembles ex ante regulation because it involves assessing the potential future impacts of a merger and setting conditions to mitigate anti-competitive risks.

Understanding this distinction between regulation and enforcement is critical because the tools, goals, and implications of ex ante regulation differ from those of ex post enforcement. This distinction applies more broadly to many of the regulatory challenges discussed above, except that the empirical literature on antitrust regulation remains very sparse, in part because until recently many jurisdictions have taken a laissez-faire approach in this domain. Most insights are derived from economic theory, and only a handful of recent papers provide some early empirical evidence (most notably, Rong et al. (2024)). In contrast, there is substantial empirical work on the effects of regulation in other areas discussed above, like privacy where, for example, GDPR has been extensively studied.

It is worth noting that market concentration can be efficient, but less frequently than often assumed. In online advertising markets, Katz and Allcott (2024) find that coordinating advertising across multiple platforms reduces inefficient ad duplication, leading to improved ad targeting. Yet, outside of a limited number of technology giants, the forces that drive market concentration, such as network effects and economies of scale, are often not as strong. For example, Farronato, Fong, and Fradkin (2024) study whether network effects dominate the value from platform differentiation in the market for pet sitters, and find that network effects are not large enough to justify concentration of economic activity on a single dominant platform.

For the small number of very large platforms, the application of traditional antitrust enforcement principles to digital platforms presents distinct challenges. Five examples are especially representative. The first is the focus on consumer prices as a proxy for market power and as a way to measure consumer welfare. When consumers pay for products whose quality is fixed, economists exploit price variations to estimate demand curves and quantify how much prices and consumer welfare would vary under counterfactual market structures. However, many digital products are free. We do not pay to use Google Search or browse Facebook. Free goods make it intrinsically difficult to estimate demand curves and quantify welfare. Yet, the price approach could be applied to other product characteristics. In particular, ads are often considered disruptive to consumers' consumption of free goods (Choi & Jeon, 2023), so ad load often shares similarities to prices (Yu, 2024). Similarly, data collection can be perceived as a

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[11]In 2022, the European Union passed the Digital Market Act and the Digital Services Act. In the United States, the Department of Justice and the Federal Trade Commission have initiated a series of lawsuits against the major technology platforms, including Google, Amazon, and Apple.

form of price, at least according to recent pay-or-consent models implemented by digital platforms in the European Union.[12]

Second, in the digital world, substitution patterns are not as obvious as in traditional goods markets. If I need a pair of hiking shoes, it it fairly straightforward to define the relevant market and substitute products. But if I consume online content as a leisure activity, should social media, news consumption, and video streaming be considered as separate markets or substitute options? Aridor (Forthcoming) takes an empirical approach to show that in fact, the relevant set of substitutes to Youtube and Instagram span multiple product categories. Importantly, substitutes can include alternatives that are not proper digital platforms, such as hotels as alternatives to Airbnb listings, or cash as a substitute for credit cards (Rose & Sallet, 2022). This requires a more data-driven market definition, rather than one solely based on product or firm characteristics.

The third issue with traditional antitrust approaches is the focus on consumers because platforms often cater to different user groups, including advertisers and sellers. It may be tempting to evaluate antitrust claims based on whether harms to one user group are offset by benefits to other user groups, the approach taken by the Supreme Court in *Ohio vs. American Express* (Wright & Yun, 2019). The problem, however, is that substitutes can include non-platform alternatives that are ignored by the multi-group approach. Therefore, an alternative solution has gained traction recently, one that heavily relies on a more traditional antitrust approach: each user group of a platform constitutes a separate relevant product market (Hovenkamp & Scott Morton, 2020). Such an approach was recently adopted by the Federal Trade Commission in its complaint against Amazon (Farronato, Fradkin, Hagiu, & Lomax, 2024). In the complaint, the Commission argues that Amazon took advantage of its dominant position in two distinct markets: the online superstore market serving consumers, and the market for online marketplace services catering to third-party sellers. This means that harm to service providers can qualify as abuse of dominant position (Fisher, 2024a), even in the absence of any abuse on the consumer side.[13]

Perhaps the more challenging fourth problem arises in merger analyses, when a large dominant platform acquires a small new entrant.[14] In the pharmaceutical industry, Cunningham et al. (2021) estimate that 5% to 7% of acquisitions are so called "killer acquisitions," where a large incumbent buys a small new entrant to prevent future competition. Existing merger analysis approaches are unable to address the long-term dynamics of a merger without an immediate impact, because the entrant does not yet have a product on the market or because it does not yet have enough users. The two extremes (banning every merger between a dominant platform and a small entrant, or allowing every merger, which is close to the practice thus far in the U.S.) are clearly sub-optimal, but it is difficult to identify the best threshold. The calibration exercise in Cabral (2024) estimates that the optimal approach would block approximately 15% of the acquisitions in the tech industry. Yet, identifying exactly *which* mergers to block is even harder given the uncertainty of market outcomes far into the future. More work is needed to quantify the costs of false positives (blocked mergers that would have not harmed competition and welfare) and false negatives (allowed mergers that end up harming competition and welfare). To make matters more difficult, a new trend is emerging that masks effective acquisitions under other forms of arrangements, which further complicates the definition of a merger and its implications. Examples include reverse acquihires, where a large firm hires the majority of a small company's talent and licenses its technology.[15] Such a shift may require a novel, outcome-based definition of mergers and acquisitions.

Given the uncertainty of complex and unpredictable dynamics in digital markets, until recently many governments have adopted a laissez-faire approach, which led to rule-making being left in the hands of dominant platforms. This is exemplified by the blocking of third-party app stores or payment solutions

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[12]https://www.edpb.europa.eu/news/news/2024/edpb-consent-or-pay-models-should-offer-real-choice_en.
[13]The merger between Penguin Random House and Simon & Schuster was blocked because of its likely impacts on authors rather than readers (https://www.nytimes.com/2022/10/31/books/penguin-random-house-simon-schuster.html?smid=nytcore-ios-share&referringSource=articleShare).
[14]The new merger guidelines of the Department of Justice and the Federal Trade Commission recognize the important role of market dynamics (https://www.justice.gov/atr/merger-guidelines).
[15]https://aimresearch.co/market-industry/how-reverse-acquihires-are-shaping-the-future-of-ai-amid-hiring-frenzies-and-layoffs.

by Apple,[16] as well as by the aggressive strategies of Google to set their search engine as the default. Allcott, Castillo, et al. (2024) find that the latter may reduce user experimentation with other search engines, leading to biased beliefs over the quality of competitors' solutions. In the last few years however, the U.S. and Europe have adopted a more interventionist stand. The U.S. has taken an ex-post, court-based approach, whereas Europe, with the Digital Markets Act (DMA) and the Digital Services Act (DSA), has fully reformed its regulation of platforms, by setting ex-ante prohibitions and requirements that large platforms must comply with. Based on the core principles of contestability and fairness, the European legislation requires, among other things, that large platforms ensure interoperability, do not engage in self-preferencing, and do not combine user data across different services. Much of the impact of these new regulations will depend on their enforcement, the effectiveness of which remains to be seen.

Self-preferencing is the fifth key concern, because of the fear that platforms may unfairly favor their own products when presenting options to users. It is worth noting that self-preferencing in the offline world, where traditional physical retailers carry a wide array of private labels and extensively promote them, has widely been seen as pro-competitive (Dubé, 2022). The difference online, some argue, is that a dominant platform acts as a single gatekeeper linking demand to supply, with no realistic alternatives. However, detecting self-preferencing is far from straightforward. Recent work is emerging on the broader effects of vertical integration (H. T. Lam, 2023; Lee & Musolff, 2023) and how to detect self-preferencing (Farronato et al., 2023; Jürgensmeier & Skiera, 2024; Raval, 2022; Reimers & Waldfogel, 2023).

While observable characteristics like product rankings and prices can provide some evidence, they may not capture the full picture, especially if platforms use sophisticated and subtle strategies to favor their products. For example, even if Amazon does not explicitly rank its products higher, it could employ other tactics, such as ensuring its products accumulate more reviews, thereby making them more appealing to consumers over time. Or, it could give its product preferential placement in its warehouses, which ensures faster delivery. These types of self-preferencing could be difficult to detect through traditional cross-sectional analysis or consumer facing data only, thus underscoring the need for more nuanced and longitudinal approaches to studying these practices and enforcing the DMA's ban on self-preferencing.

When an increasing number of decisions are made by algorithms, questions arise as to how to detect non-competitive behavior. A case in point is pricing algorithms. Price collusion was typically proved in the courts by showing evidence that people intentionally met and coordinated on setting prices. Yet, Calvano et al. (2020) have shown that pricing algorithms can also learn to collude in ways that cannot be proved in court. Moreover, other research has shown that even without algorithmic collusion, prices can exceed competitive levels (Brown & MacKay, 2023; Lambin, 2024). Much of this literature raises the question of whether collusive behavior needs to be proved based on input (i.e., explicit and intentional coordination) or on outcomes (i.e., prices are higher than the competitive equilibrium would predict).

3.2. Directions for Future Research

Empirical studies that directly tackle regulation concerning externalities, labor, consumer privacy, toxic or illegal content, and antitrust remain scarce. The theoretical literature is very clear on the main trade-offs, but the key challenge is quantifying where the net effects call for intervention, and whether intervention should involve changes to the regulation or its enforcement. The main constraint remains data availability. Although many of these platforms collect much larger amounts of data than traditional companies, their willingness to share proprietary data for policy-relevant research is limited, given the inherent risk of such research for the company's business model and strategy.

One exception is worth mentioning. In 2018, Facebook and about 15 other academics launched an initiative (the U.S. 2020 Facebook and Instagram Election Study) that granted researchers widespread and detailed access to Facebook data, experiments, and algorithms, in order to study the role of social

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[16]https://cepr.org/voxeu/columns/apples-exclusionary-app-store-scheme-existential-moment-digital-markets-act.

media in shaping political outcomes.[17] Extensive planning and pre-registration efforts were accompanied by stringent safeguards to protect research integrity from the risk of company pressure.

Short of this unique collaboration opportunity, researchers need to develop creative methods for data collection. One such method involves using browser extensions (Farronato, Fradkin, & Karr, 2024), which can manipulate and track users' online behavior, simulating the kind of data collection and controlled experiments that platforms themselves conduct. This tool has allowed researchers to gather organic data on consumer behavior, such as how users interact with search results on platforms like Amazon (Farronato et al., 2023), how they make privacy choices online (Farronato, Fradkin, & Lin, 2024), and how they choose between Google Search and competing search engines (Allcott, Castillo, et al., 2024).

Academics can help assess the intended and unintended consequences of regulatory interventions. While much of the focus in research on regulation affecting digital platforms has traditionally been on unintended consequences, it is equally important to evaluate whether regulations achieve their intended goals (G. A. Johnson et al., 2023), such as enhancing competition and protecting consumer welfare.

A multi-disciplinary approach is needed to study the complexities of fast-changing digital goods. Historically, law and economics have been the disciplines focused on identifying the trade-offs and formulating tests behind various forms of regulation (Hamilton et al., 1929). Yet, it is increasingly important to understand the intricacies of new business models from an operational and strategic perspective (Jacobides & Lianos, 2021) to anticipate the likely dynamics and evolution of firms and the markets where they operate.

The multi-disciplinary approach also involves acknowledging that consumers do not always behave as rational decision-makers, which is the assumption behind many traditional industrial organization approaches. Platform users can have biased beliefs (Fisher, 2024b) and inconsistent preferences between the short- and the long-run (Grubb, 2015), which platforms can easily exploit to their advantage. More work is needed to understand consumer biases and impulses, and to prevent dominant platforms from exploiting them.

Finally, Tirole (2024) calls for more work at the intersection of industrial policy and antitrust regulation. He argues that the unique characteristics of digital markets, such as high fixed costs, network externalities, and the potential for monopoly power, necessitate a rethinking of both industrial policy and antitrust regulation as complementary tools that need to be adapted to effectively address the complexities of the digital economy.

4. Conclusions

While this paper has offered an examination of the existing work on digital platforms and how competition policy, regulation, and industrial policy may adapt as a result, it also highlights several critical areas that warrant further research.

On information design, future research should focus on understanding the broader effects of platform interventions, particularly in information design at the collection, aggregation, and disclosure stages. There is a need to explore whether platform interventions are universally beneficial or if there are cases where they could be counterproductive. Additionally, researchers should investigate the complex interactions between different interventions and develop experimental designs that can accurately capture these dynamics.

As digital platforms continue to reshape traditional markets, it is crucial to re-evaluate existing regulatory frameworks. Future research should explore the effectiveness of these regulations in the context of digital platforms and consider how online monitoring could complement or substitute traditional screening mechanisms. There is also a need to examine the interaction between government regulation and platform rules to identify optimal combinations of the two for consumer protection.

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[17] https://research.facebook.com/2020-election-research/. The publications originating from this initiative include Allcott, Gentzkow, et al. (2024), González-Bailón et al. (2023), and Nyhan et al. (2023).

The unique economic features of digital platforms, such as network effects and economies of scope, create significant externalities that affect labor conditions, data privacy, and market power. Future research should aim to quantify these externalities and assess the need for regulatory intervention. A multidisciplinary approach is essential to understand the intricacies of digital platforms, especially in the context of fast-changing digital goods. Additionally, there is a need to develop creative methods for data collection to overcome the challenges posed by limited access to proprietary data.

The questions outlined above underscore the need for ongoing interdisciplinary research to develop regulatory frameworks that are adaptable, effective, and capable of addressing the unique challenges posed by the digital economy. By focusing on these critical areas, future research can help to ensure that digital markets remain competitive, innovative, and fair for all stakeholders.

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