Platform Safety: Strict Liability versus Negligence*

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Abstract

This paper explores whether platform liability should be strict or negligence-based. In the model, two-sided platforms get revenue from two sources: selling products or services to consumers and selling advertising (or information) to others. There are indirect network effects: higher consumer participation generates more revenue from advertising or data sales. Platforms may take costly and unobservable precautions to reduce risks of consumer harm. If network effects are weak (strong), the price charged to consumers is positive (zero). If the consumers' price is positive, then both strict liability and negligence lead to efficient precautions and consumer participation. If the price is zero, then strict liability stimulates more user participation and higher social welfare than the negligence rule. Bilateral care (i.e., consumer precautions), third parties (e.g., government agencies, lawyers), and platform market power are also examined.

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1 Introduction

In the last few years, many high-profile lawsuits have been brought against internet platforms. In 2019, Facebook paid $5 billion to settle FTC charges that Facebook was sharing users' personal information with third-party apps without the users' knowledge, and took inadequate precautions when dealing with known violators.[1] In 2022, Epic Games agreed to pay over $500 million to settle charges that the company deployed methods to trick players of the online video game Fortnite into making unwanted purchases. About half of this was designated as refunds to Fortnite gamers.[2] In 2023, the United States Supreme Court heard oral arguments in a pair of cases, one against Google and the other against Twitter, concerning the extent to which platforms may be held liable for hosting terrorist content.[3]

This paper asks whether online platforms should be liable for the harms suffered by users and, if so, whether liability should be strict or negligence based. We analyze a simple model of two-sided platforms. Platforms generate revenue in two ways, from selling a product or service to consumers, and from selling advertising or data use to others. There are network effects at play. When a platform grows and acquires more users, the platform also generates more revenue from advertising or data sales. Technically, the extra revenue per consumer that comes from advertising or data sales helps to offset the platform's marginal cost of serving a consumer. If the network effects are sufficiently strong, then the platform will set a price of zero for the consumers to stimulate higher consumer participation.

We assume that platforms can take costly precautions to improve the safety of the platforms. A platform's effort reduces the likelihood of consumer harm and is not directly observed by consumers. Consumers are assumed to be sophisticated, understand the platform's incentives, and rationally anticipate future legal action (including the payment of damage awards). Using this simple framework, we explore the welfare implications of platform liability on platform safety and user participation. In particular, we compare the negligence rule, where a platform must compensate victims for their losses if the platform's effort falls short of the due-care level (set at the socially-efficient level), to strict liability where the platform must compensate the victims regardless of the care taken.

We begin with the simple case of a competitive market where the platforms can take

[1] See https://www.ftc.gov/news-events/news/press-releases/2019/07/ftc-imposes-5-billion-penalty-sweeping-new-privacy-restrictions-facebook

[2] See https://www.ftc.gov/enforcement/refunds/fortnite-refunds and https://www.ftc.gov/news-events/news/press-releases/2022/12/fortnite-video-game-maker-epic-games-pay-more-half-billion-dollars-over-ftc-allegations.

[3] Both cases arise from the 2015 killing of Nohemi Gonzalez, a US citizen, in a terrorist attack in Paris, France. *Gonzalez v. Google* alleges that Google assisted the terrorists by letting them use the platform to recruit members and plan terrorist attacks. The court considered whether Section 230 of the Communications Decency Act immunizes platforms for targeted recommendations made by their algorithms. In *Twitter Inc. v. Taamneh*, the court considered whether the platforms can be liable under the Anti-Terrorism Act (ATA) for aiding and abetting terrorists.

unilateral care to reduce the harm to consumers.[4] We show that the welfare effects of the two liability rules, strict liability and negligence, hinge on the level of network effects (revenue from advertising or data sales). When the extra revenue per consumer is low, so the network effects are small, then the price paid by consumers is positive. In this case, strict liability and negligence perform equally well. First, under both liability rules, the platforms have the incentive to take the socially-efficient level of care. Second, under both liability rules, since the "full price" paid by consumers reflects their accident losses, the consumers make socially-efficient participation decisions.[5]

If the platforms' advertising or data-usage revenue per consumer is high, so the network effects are large, then the platforms charge consumers a price of zero and earn positive rents. In this case, although negligence and strict liability lead to socially-efficient precautions, they both lead to suboptimal user participation. This is happening because the price is "stuck" at zero and cannot adjust downwards.[6] The marginal consumer, when deciding whether to join a platform, does not consider the positive spillovers that their participation has. We also show that when network effects are large, strict liability performs better than the negligence rule. With strict liability, consumers receive compensation after experiencing an accident while with the negligence rule they do not. The damage award with strict liability is like giving a rebate to consumers who have in fact joined the platforms for free. Strict liability has the same effect on participation as a negative price would have. Although the platforms take the very same care level with both rules, strict liability stimulates more consumer participation.

We then extend the simple model to consider bilateral care where consumers can also take precautions to reduce the risks that they face. If network effects are small then the negligence rule and strict liability with a defense of contributory negligence[7] lead to the socially-efficient outcome. Strict liability *without* the defense of contributory negligence performs worse, as consumers will decline to take efficient precautions. If network effects are in a middle range, then strict liability with a defense of contributory negligence performs better than the other two rules. As in the simple model, strict liability has the advantage of stimulating greater user participation. Finally, and perhaps surprisingly, if network effects are very large then strict liability *without a defense of contributory negligence* performs the best of all. Although this rule leads to suboptimal consumer precautions (taking participation fixed), it lowers the consumers' full price and stimulates even more consumer participation.

Two additional extensions of the simple unilateral-care model are considered. We consider a setting where liability is decoupled in the sense that a fraction of the damage

[4]Bilateral care, where the consumers can take precautions as well, is considered in Section 3.1.

[5]This result is familiar from the literature on products liability. See discussion below.

[6]A negative price would motivate users to artificially inflate demand and attract "ghost users." See the literature review below.

[7]Under strict liability with a defense of contributory negligence, the platform must compensate the consumer for their loss, assuming that the consumer took reasonable precautions to avoid the accident. If the consumer failed to take reasonable precautions, then the platform is not liable for the consumer's loss.

award goes to third parties (e.g., the treasury or contingent-fee lawyers). If network effects are small, then the negligence rule performs better than strict liability. The reason for this is that the damage awards with strict liability are effectively taxed by third parties, thus distorting the level of consumer participation. If network effects are sufficiently large, however, then strict liability performs better than the negligence rule. We also consider monopoly platforms, and show that qualitative rankings of the liability regimes is the same as in the baseline model with platform competition.

Our paper is related to the law-and-economics literature on liability rules. The seminal paper by Shavell (1980) compares the effects of strict liability and negligence-based liability on care levels and activity levels. The most relevant part of his article is a market setting where injurers are competitive firms and victims are consumers. If care is unilateral and consumers are rational and sophisticated, then both rules are socially efficient.[8] In the bilateral case where consumers take care, too, the negligence rule and strict liability with a defense of contributory negligence are efficient.[9] Our results are strikingly different. In contrast to Shavell (1980), when care is unilateral, we show that strict liability is superior to the negligence rule. In markets with strong network effects, strict liability reduces the full price paid by consumers (as they collect damage awards ex post) and therefore stimulates demand. The negligence rule does not have this effect. When care is bilateral, we show that strict liability with a defense of contributory negligence is superior when network effects are in a middle range and liability *without a defense of contributory negligence* is superior when network effects are sufficiently high.

Other papers in the products liability literature show that strict products liability can motivate firms to invest in safety but may reduce consumer demand. For example, Polinsky and Rogerson (1983) consider a model where consumers systematically underestimate product risks. Although strict liability and negligence lead to the same safety investments, strict liability leads to higher market prices and lower market output. To understand why, suppose that consumers believe that the likelihood of harm is zero. In this case, relative to the negligence rule, strict liability would shift the supply curve upward with no corresponding downward shift in demand.[10] By contrast, our paper shows that for platform markets, if consumers are sophisticated and network effects are strong, strict liability *stimulates demand* (relative to the negligence rule).[11]

There is a large and developing literature on "gatekeepers" and extending liability to third parties.[12] See Van Loo (2020a, 2020b) on the gatekeeping role of big tech platforms

[8]Shavell (1980) Part III.B.(ii) and Table 1. Oi (1973) and Hamada (1976) explore products liability models where the firms' care is observed by the consumers prior to sale.

[9]See Shavell (1980) Part IV.B.(ii) and Table 2. Strict liability without a defense of contributory negligence distorts the consumer's care and reduces social welfare.

[10]Polinsky and Rogerson (1980) show that strict liability is better than the negligence rule if the market is competitive, but may not be desirable if sellers have market power. Intuitively, the negligence rule can counterbalance the monopoly distortion. See also Spence (1977) and Epple and Raviv (1978) on liability and consumer misperceptions.

[11]Other papers that show that products liability can motivate firms to invest in safety but may reduce consumer demand include Simon (1981), Daughety and Reinganum (1995), Hua and Spier (2020).

[12]See Kraakman (1986) for a general taxonomy of gatekeeper enforcement strategies.

(e.g., Facebook and Google). Hamdani (2002 and 2003) argues for liability on internet service providers and gatekeepers such as lawyers and accountants. Dari Mattiacci and Parisi (2003) discuss vicarious liability on an injurer's employer. Arlen and MacLeod (2003 and 2005) show that holding managed care organizations liable for medical malpractice by physicians can increase the physicians' care levels. Hay and Spier (2005) examine whether manufacturers should be liable when the usage of their products by consumers cause harm to bystanders. Our paper instead investigates the effects of different liability regimes on platform safety and user participation.

One common observation in the literature on multi-sided platforms is that, when cross-side externalities are large, platforms find it optimal to charge one side of participants and offer free services or even subsidies to the other side.[13] Many studies (Hagiu and Wright, 2015, 2018; Karle et al., 2020, among others) assume that platforms set a price of zero for one side of users. Armstrong and Wright (2007) and Choi and Jeon (2021) justify non-negative price constraints by considering adverse selection and moral hazard issues.[14] Gans (2022) shows further that, if consumers can freely dispose of products/services, then a zero price may occur in equilibrium. Belleflamme and Peitz (2021, pages 157-158) provide other possible reasons for non-negative prices, such as constraints from competition policies. In our paper, when negative prices are not feasible, liability compensation becomes a "rebate" and stimulates user participation.

The platform literature has largely ignored the important role of platform liability with just a few notable exceptions.[15] Hua and Spier (2022) present a model where imposing strict liability (sometimes with partial damage compensation) on platforms induces platforms to raise prices and exert auditing efforts to deter or remove harmful firms. Jeon et al. (2022) examine how negligence-based liability motivates platforms to remove patent-infringing products and affects brand owners' innovation incentives.[16] These studies do not compare strict liability and negligence.

Our paper is organized as follows. Section 2 presents the baseline model with competitive platforms and unilateral care. Section 3 considers three extensions: bilateral care, value captured by third parties, and monopoly platforms. Section 4 concludes.

[13]Caillaud and Jullien (2003), Armstrong (2006), Hagiu (2006), and Weyl (2010) allow for negative prices or subsidies for users to join a platform. Rochet and Tirole (2003, 2006) focus on per-transaction fees charged by platforms instead of participation fees.

[14]For example, if a platform offers rebates to consumers for joining the platform, consumers may artificially inflate their demand.

[15]Hagiu (2009), Julien and Pavan (2019) Choi and Mukherjee (2020), Hagiu and Wright(2015, 2018) and Teh (2022) examine platforms' non-pricing strategies such as seller exclusion, information management, control right allocation, and governance. These above studies do not consider the issue of platform safety and liability.

[16]Buiten et al. (2020) and Lefouili and Madio (2022) discuss informally the desirability of platform liability.

2 Unilateral Care

Suppose that platforms provide services to consumers. We will assume in this section that the platforms are competitive, although this assumption may be relaxed without changing the qualitative results.[17] The platforms get revenue through two sources: the price charged to consumers, p, and payments from third parties, α. The price $p \geq 0$ is endogenous while $\alpha > 0$ is an exogenous parameter.

This simple framework allows for a range of business models. For example, Facebook, TikTok, Twitter and others allow consumers to access the platforms for free and earn revenue from third party advertisers and/or data users.[18] By contrast, users on platforms such as Twitch, Patreon, and OnlyFans pay membership fees to access exclusive content shared by musicians and artists, though these platforms also get revenue from advertising.[19] The framework also accommodates traditional business models with no advertising revenue at all.[20]

The consumers' gross utility from participating on a platform, v, is distributed according to p.d.f. and c.d.f. $f(v)$ and $F(v)$, respectively, on the real number line. We will assume that $(1 - F(v))/f(v)$ is a decreasing function of v.[21] The consumers are also exposed to risks from platform usage. If an accident occurs, each consumer will suffer a loss $d > 0$. These harms could include fraudulent credit card charges,[22] privacy breaches, bullying, and hate speech.

The platforms can invest resources (effort) $e \geq 0$, measured per consumer, to reduce the probability of harm, $\pi(e)$. We assume that improving platform safety is expensive, $\pi'(e) < 0$, and that $\pi''(e) > 0$, $\pi(0) = 1$, $\pi'(0) = -\infty$, and $\lim_{e\to\infty} \pi(e) = 0$. These assumptions imply that although it is possible for the platforms to mitigate the risk to consumers, it is not possible to eliminate the risks entirely. For example, Facebook and Google claimed that they invest billions of dollars to identify and remove misinformation or fraudulent advertisements and to protect user data.[23]

[17] See Section 3.3.

[18] More than 80% of Google's 2020 revenues came from selling ads. Similarly, most of Facebook's revenue comes from advertising. See Google's and Meta's annual reports.

[19] https://sharecreative.com/news/paid-subscriptions-social-media/

[20] Video streaming service Hulu has no ads. Other platforms, including Netflix, offer both inexpensive subscriptions with ads and more expensive subscriptions without ads.

[21] This is satisfied by the uniform and normal distributions, among others.

[22] Data from the US Federal Trade Commission suggests that social media was the source of eleven percent of reported consumer fraud cases in the last quarter of 2022, compared to just four percent in the last quarter of 2019. The agency reported $770 million in social-media-based scams in 2021, up more than seven-fold since 2019. See "New FTC Order Pressures Tech Platforms Over Fraudulent Ads," *Wall Street Journal*, March 21, 2023.

[23] https://www.reuters.com/technology/facebook-spent-over-13-bln-safety-security-since-2016-2021-09-21/, and https://blog.google/technology/safety-security/why-were-committing-10-billion-to-advance-cybersecurity/ Similarly, Amazon uses different verification methods and machine learning technology to stop "bad actors before they can register or list a single product" on Amazon's website. According to Amazon, "In 2018, our teams and technologies proactively blocked more than three billion suspect listings for various forms of abuse, including non-compliance, before they were published to our store." https://www.aboutamazon.com/news/company-news/product-safety-and-compliance-in-our-store

The simple framework described in the last paragraph has broad application to platform incentives. The platform's choice variable e could represent the restrictions imposed by the platform on the advertisers, app developers, and consumers. The platform can prohibit certain types of advertisements (e.g., banning alcohol and cigarette ads), adopt filters to block the sharing of harmful content among users (e.g., to prevent suicide videos on TikTok from "going viral"), or limit the user data shared with app developers. Restrictions along these lines would make the platform safer for consumers but would also reduce the platform's revenues.[24]

The timing of the game is as follows. First, market forces determine the price, $p \geq 0$. Since the platforms are competitive, the price will reflect the platforms' expected unit cost (including future liability costs, if any) or zero, whichever is higher. We assume that a price below zero is infeasible.[25] Second, consumers decide whether to pay price p to join a platform. If a consumer joins, the platform gets price p from the consumer and additional revenue α per consumer from third parties. Third, the platforms choose effort, e. Note that the platforms' effort choices are not observed directly by the consumers. Consumers are sophisticated, however, and draw rational inferences about e in equilibrium.[26] Finally, accidents occur with probability $\pi(e)$.

We will compare two liability rules: negligence and strict liability. With the negligence rule, the social planner mandates a care level e^N. If there is an accident on a platform and the platform's effort falls short of the due-care level, $e < e^N$, then the platform must compensate consumers for their harm. If the platform's effort meets or exceeded the due care level, $e \geq e^N$, then the platform is not held liable for consumers' losses. With strict liability, the platform must compensate consumers for their loss regardless of the level of care.

2.1 Social Optimum

The social welfare function is the sum of the benefits and costs of all parties, represented in monetary units. Given care level e, we say that it is *socially efficient* for a consumer with valuation v to join a platform if the net social benefits of their joining, including the network benefit α, exceeds the costs, $v + \alpha \geq \pi(e)d + e$. It is *socially inefficient* for the consumer to join the platform when the reverse is true.

Suppose that the social planner could choose the safety level e and a participation threshold $\widehat{v}$ where consumers with $v \geq \widehat{v}$ join the platforms and those with $v < \widehat{v}$ do not.

[24] Formally, a restriction level e would reduce the probability of harm $\pi(e)$ but also reduce per-user advertising revenue from α to $\alpha - e$.

[25] A negative price would attract "ghost users" who do not meaningfully engage with the platform. Paying these users to join would be waste of money, as advertisers would not be willing to pay α to access these users. See the literature review for further discussion.

[26] Consumers understand the incentives that are created by the market and by the liability system, and form rational expectations about platform safety.

Social welfare may be written as:

$$S(e, \widehat{v}) = \int_{\widehat{v}}^{\infty} [v + \alpha - (\pi(e)d + e)] f(v) dv. \tag{1}$$

Social welfare is maximized by e^0 and v^0 that satisfy:

$$\pi'(e^0)d + 1 = 0 \tag{2}$$

and

$$v^0 = e^0 - \alpha + \pi(e^0)d. \tag{3}$$

Equation (2) implies that the socially-optimal effort e^0 equates the marginal benefit of effort, $-\pi'(e^0)d > 0$, with the marginal cost, 1. In equation (3) the net social benefit associated with the threshold consumer v^0 is zero. In other words, given e^0, it is socially-efficient for users with $v \geq v^0$ to join the platforms.

It is important to note that the socially-optimal participation threshold, v^0, defined in (3) may in fact be *negative*, depending on the strength of the network effects, α. In particular, if $\alpha > e^0 + \pi(e^0)d$ then the threshold $v^0 < 0$. In other words, when the network effects α from higher user participation are strong, then it is socially efficient for consumers who may even dislike the platforms (in the sense that they would not pay a positive price to join the platforms) to participate on the platforms none-the-less.

2.2 Negligence Rule

Suppose that liability is negligence-based with the due-care level equal to the socially-optimal level defined in (2), $e^N = e^0$.[27] If a platform's effort falls short of the due care level, then the platform must pay $w = d$ to the consumer, making the consumer whole. If the platform's effort meets or exceeds the due-care level, then the platform is not liable for the consumer's losses.

Under the negligence rule with due care $e^N = e^0$, the platforms have an economic incentive to meet (but not exceed) the due-care standard. If they just meet the standard, their marginal cost is e^0, while if they fall short of the standard their marginal cost is $e + \pi(e)d$. Since $e + \pi(e)d$ is minimized at e^0 by construction,[28] the platform has a doubly-strong incentive to meet the due-care standard (as they can avoid the liability payment $w = d$, too). So the platforms will take the socially-optimal precautions $e = e^0$ defined in (2).[29]

Now consider the platforms' pricing decisions. If a platform attracts a consumer, the platform gets price $p \geq 0$ from the consumer, extra revenue $\alpha > 0$ from third parties, and

[27] We will see below that if α is small then this due-care standard leads to socially-optimal participation by consumers. If α is large then social welfare may be higher with a due-care standard above e^0. See the remark below.

[28] See equation (2).

[29] The platforms would not exceed due care, as doing so would increase their marginal cost but would have no effect on liability.

invests e^0 to meet the due care standard and avoid liability. So a platform's surplus per consumer is $p + \alpha - e^0$. Since the platforms are competitive, they will compete the prices down to $e^0 - \alpha$ or zero, whichever is larger:

$$p^N = \max\{0, e^0 - \alpha\}. \tag{4}$$

Notice that if the network benefit α is large, then the competitive price in (4) will be stuck at zero. In this case, the platforms are earning positive rents.

Next, consider a consumer's decision to join a platform. Recall that consumers are sophisticated, and understand that the platforms have an incentive to meet the due-care standard e^0 and there is a risk $\pi(e^0)$ that they will suffer (uncompensated) harm, $d > 0$. So, from a consumer's perspective, the "full" price of joining the platform is $p^N + \pi(e^0)d$. A consumer with valuation $\widehat{v}$ is indifferent between joining the platform and not joining if $\widehat{v} = p^N + \pi(e^0)d$. Using (4) we have $v^N = \max\{0, e^0 - \alpha\} + \pi(e^0)d$ or equivalently

$$v^N = \max\{\pi(e^0)d, v^0\} > 0 \tag{5}$$

where $v^0 = e^0 - \alpha + \pi(e^0)d$ from equation (3). Notice that the participation threshold is strictly positive. Comparing v^N in (5) to v^0 in (3) reveals that the consumers' private decision to participate under the negligence rule may or may not be socially efficient.

Suppose the network effects are weak, $\alpha \leq e^0$. According to equation (4), platform competition drives the the price down to $p^N = e^0 - \alpha \geq 0$. Since consumers bear the risk of accidents with the negligence rule, the "full" price that the consumers pay is $p^N + \pi_0 d = e^0 - \alpha + \pi_0 d = v^0$. Since the full price reflects the social cost of participation – including the positive network benefit α – the consumers make the socially-optimal participation decision. This result is familiar from the literature on products liability (Shavell, 1980).[30]

If the network effects are strong, $\alpha > e^0$, then (4) implies that the competitive price is $p^N = 0 > e^0 - \alpha$. Since the market price cannot be negative, the price cannot adjust to fully reflect the network benefit α. The full price that the consumers pay, $p^N + \pi(e^0)d = \pi(e^0)d$, is larger than the social cost, $e^0 - \alpha + \pi(e^0)d = v^0$. The consumers are not taking into account the positive externality that their participation creates for the platforms.

Remark on choice of due-care standard. The preceding analysis assumed that the due-care standard is the socially-optimal effort level e^0. If $\alpha > e^0$ then a social planner would in fact want to commit to a due-care standard that is larger than e^0. Holding participation fixed, raising the due-care standard to slightly above e^0 would reduce social welfare slightly, although this effect is very small (mathematically it is a second-order effect). Raising the due-care standard above e^0 would however stimulate consumer participation, something that has a first-order effect on social welfare. Since the due-care standard is distorted away from the socially-desirable level, it is clear that the socially-optimal outcome is not achieved.

[30] See Shavell's (1980) analysis of accidents between sellers and consumer-victims. See Part III.B.ii and Table 1 in Shavell (1980).

2.3 Strict Liability

Now, suppose that liability is strict. If a platform causes an accident, then the platform must pay damages $w = d$, making the consumer whole. The platform must pay for the consumer's damages, even if the platform took all cost-justified precautions to mitigate the platform risks. In the United States, manufacturers and bricks-and-mortar sellers may be held strictly liable for harms caused by defective products. See for example the Restatement (Third) of Torts (1998). A California court ruled that Amazon could be held strictly liable for a defective laptop battery that was sold by third-party vendors.[31] There have been discussions on whether strict liability should be applied for data breach cases as well.[32]

Recall that the platforms choose their effort levels after the price p has been set. The platforms' per-consumer revenue is $p + \alpha$ and, with strict liability, the platforms' per-consumer cost includes the effort cost plus the future liability cost, $e + \pi(e)w = e + \pi(e)d$. Since the cost is minimized when $e = e^0$ defined in (2), the platforms will choose the socially-optimal effort level with strict liability, too. Platform competition will drive price down to

$$p^L = \max\{0, e^0 - \alpha + \pi(e^0)d\}. \tag{6}$$

If the extra revenue α is sufficiently large, then the competitive price in (6) is zero and the competitive platforms enjoy positive rents. Comparing the price with strict liability in (6) to the price with the negligence rule in (4) reveals that $p^L > p^N$ when α is small. The price is higher with strict liability because the platforms' marginal costs are higher due to the expected liability payments.

Now consider a consumer's decision to join a platform. The consumer is sophisticated and understands that the platform is risky. The consumer also rationally anticipates that any future accident losses will be compensated in full by the platform. So the consumer's full price of joining a platform is simply p^L defined in (6). A consumer with valuation $\widehat{v}$ is therefore indifferent between participating and not if $\widehat{v} - p^L = 0$. Using equations (3) and (6), the participation threshold with strict liability is

$$v^L = \max\{0, v^0\}. \tag{7}$$

Equation (7) reveals that consumers' private decision to participate under strict liability may diverge from the social optimum.

Suppose the network effects are weak, $\alpha \leq e^0 + \pi(e^0)d$. From equation (6) we have $p^L = v^0 > 0$. Since consumers are made whole with strict liability, and buy on the basis of price alone, the consumers' participation threshold in (7) in socially optimal too, $v^L = v^0$. This makes sense. When α is small, the price paid by the consumers reflects the effort costs and expected accident losses, e^0 and $\pi(e^0)d$, and the social benefits α. So the consumers' participation decisions are socially efficient.[33]

[31] See Bolger v. Amazon.com, LLC, 53 Cal.App.5th 431, 267 Cal.Rptr.3d 601 (2020).

[32] See Cooper and Kobayashi (2022).

[33] This result replicates results from the literature. See Shavell (1980) Part III.B.ii on strict liability versus negligence in the unilateral-care model when firms are sellers and victims are consumers.

If the network effects are strong, $\alpha > e^0 + \pi(e^0)d \geq 0$, then (6) and (7) imply that the competitive price $p^L = 0 > v^0$ and the participation threshold $v^L = 0 > v^0$ are too high. This distortion arises because the social cost of a consumer joining the platform is negative, $e^0 - \alpha + \pi(e^0)d = v^0 < 0$. Since $p^L = 0 > v^0$, the level of consumer participation on the platforms is socially insufficient. The consumers are not taking into account the positive spillovers of their participation on others.

Remark on damage multipliers. The preceding analysis considers strict liability with compensatory damages $w = d$. If $\alpha > e^0 + \pi(e^0)d$, then a social planner would impose damage multipliers such that $w > d$. Holding participation fixed, raising the damage payment slightly above d would distort the platforms' effort and reduce social welfare, though this effect is very small (it is a second-order negative effect). Raising the damage payment would however stimulate participation, which has a first-order positive effect on social welfare.

2.4 Social Welfare Analysis

The analysis in the previous subsections showed that the negligence rule and strict liability are equally good at creating incentives for platform safety, $e^N = e^L = e^0$. The two rules differ, however, in their effects on user participation and social welfare. Comparing v^0, v^N, and v^L in equations (3), (5), and (7) gives the following result.

Proposition 1. *Suppose that there are competitive platforms which can take unilateral care. The negligence rule with due-care standard $e^N = e^0$ and strict liability with compensatory damages $w = d$ both lead to the socially-efficient platform safety, $e^N = e^L = e^0$, but differ in consumer participation.*

1. *If $\alpha \leq e^0$ then $v^N = v^L = v^0$. The negligence rule and strict liability both lead to socially-efficient participation.*

2. *If $\alpha \in (e^0, e^0 + \pi(e^0)d]$, then $v^N > v^L = v^0$. The negligence rule leads to socially-insufficient participation. Strict liability is better than the negligence rule.*

3. *If $\alpha > e^0 + \pi(e^0)d$ then $v^N > v^L > v^0$. Strict liability and the negligence rule lead to socially-insufficient participation. Strict liability is better than the negligence rule.*

Case (1) of Proposition 1 resembles the observation in Shavell's (1980) analysis of products liability when care is unilateral. If firms are sellers and victims are consumers, then strict liability and negligence both create efficient incentives for care and activity levels. In our framework, with small network effects (small α), the equilibrium price is positive under both liability rules. The negligence rule with $e^N = e^0$ and strict liability with compensatory damages $w = d$ implement the first-best outcome and therefore are equivalent.

However, the two rules are no longer equivalent when network effects, α, are large. In case (2) of Proposition 1, the equilibrium price is zero under the negligence rule,

which leads to socially insufficient participation, while the price is still positive under strict liability, which implements efficient participation. Therefore, strict liability is more efficient.

In case (3), with very large network effects, the equilibrium price is always zero under both rules. Consumers' participation incentives are insufficient. Damage compensation under strict liability reduces the "full" price paid by consumers and stimulates participation. Therefore, strict liability is more efficient.

Remark on choice of due-care standard. As remarked earlier, under the negligence rule, if $\alpha > e^0$ then a social planner would in fact choose a higher due-care standard $e^N > e^0$, which distorts the platforms' effort but stimulates consumer participation. In this case, strict liability with compensatory damages is still more efficient than the negligence rule. To see this, note that the participation threshold under the negligence rule with $e^N > e^0$ is $v^N = \max\{\pi(e^N)d, e^N - \alpha + \pi(e^N)d\}$, while the participation threshold under strict liability is $v^L = \max\{0, v^0\} \leq v^N$. Therefore, if $\alpha > e^0$, the negligence rule with any due-care standard is less efficient than strict liability, which implements the first-best effort and leads to more consumer participation.

Remark on imperfect information. Our analysis assumed that consumers have imperfect information. Now suppose that consumers observe the precautions taken by the platforms when they decide whether to join. If network effects are weak, $\alpha \leq e^0$, the price that consumers pay is positive and consumer participation under negligence and strict liability rules are the same. If network effects are strong, $\alpha > e^0$, strict liability outperforms negligence. With the negligence rule, platforms over-invest in safety to the point where profits are dissipated, $e^N = \alpha > e^0$, and consumer participation is socially insufficient, $v^N = \pi(e^N)d > v^0$.[34] With strict liability, platforms have an incentive to choose the socially-optimal safety level, $e^L = e^0$, the consumer participation constraint is the same as before, $v^L = \max\{0, v^0\}$. Since $e^N > e^L = e^0$ and $v^N > v^L \geq v^0$, strict liability is unambiguously superior to the negligence rule.

Remark on consumer misperceptions. Stict liability remains superior to the negligence rule when consumers systematically underestimate platform risk. Suppose consumers believe that there is no risk of harm. The platforms would choose socially-optimal effort under strict liability and negligence, $e^L = e^N = e^0$. Consumers, unaware that they may be harmed in the future, buy on the basis of price alone. With strict liability, the participation threshold is $v^L = p^L = \max\{0, v^0\}$ defined in (6) and with negligence it is $v^N = p^N = \max\{0, e^0 - \alpha\}$ defined in (4). When network effects are weak, $\alpha < e^0 + \pi(e^0)d$, strict liability achieves the first-best outcome and the negligence rule leads to excessive participation, $v^L = v^0 > v^N$. This result is familiar from the products liability literature (see Polinsky and Rogerson, 1983). When network effects are strong, then the two rules lead to the same socially-insufficient consumer participation, $v^L = v^N = 0 > v^0$.

[34] To see why, $v^N = \pi(e^N)d + e^N - \alpha > \pi(e^0)d + e^0 - \alpha = v^0$.

3 Extensions

3.1 Bilateral Care

The baseline model considers unilateral care taken by platforms. In practice, consumers can take precautions as well when using the services. For example, consumers can check platforms' data usage policies and adjust their data-sharing permissions, investigate the truthfulness of posted content (e.g., through fact-checking websites like Snopes), and be mindful of fraudulent advertising. People can also install parental control apps to prevent their children from accessing certain platform content. In this section, assume that, the probability of accidents is $\pi(e, x)$, where e is the effort taken by platforms and x is the precaution taken by consumers. Assume that improving safety is expensive, $\frac{\partial \pi(e,x)}{\partial e} < 0$ and $\frac{\partial \pi(e,x)}{\partial x} < 0$. Moreover, $\frac{\partial^2 \pi(e,x)}{\partial e^2} > 0$, $\frac{\partial^2 \pi(e,x)}{\partial x^2} > 0$, $\frac{\partial \pi(0,x)}{\partial e} = -\infty$, $\frac{\partial \pi(e,0)}{\partial x} = -\infty$, and $\pi(0,0) = 1$.[35] The other assumptions are the same as in the baseline model.

Social Optimum. Suppose that the social planner could choose the care levels, e and x, as well as the participation threshold $\widehat{v}$ where consumers join the platforms if and only if $v \geq \widehat{v}$. Social welfare is:

$$S(e, x, \widehat{v}) = \int_{\widehat{v}}^{\infty} [v + \alpha - (\pi(e, x)d + e + x)] f(v) dv \tag{8}$$

Social welfare is maximized by e^0, x^0 and v^0 that satisfy:

$$\frac{\partial \pi(e^0, x^0)}{\partial e} d + 1 = 0; \tag{9}$$

$$\frac{\partial \pi(e^0, x^0)}{\partial x} d + 1 = 0; \tag{10}$$

and

$$v^0 = e^0 + x^0 - \alpha + \pi(e^0, x^0)d. \tag{11}$$

As before, the socially-optimal care levels for the platforms and consumers equate the marginal benefit of care with the marginal cost of care. Our assumptions guarantee that the socially-optimal care levels are positive, $e^0 > 0$ and $x^0 > 0$. Also, as before, the socially-optimal participation threshold v^0 may be positive or negative, depending on the strength of the network effects, α. When the network effects are large, then v^0 defined in (11) is negative.

In addition to the negligence rule with $e^N = e^0$ and strict liability with compensatory damages ($w = d$), we will also consider strict liability with a defense of contributory negligence. With this third rule, the platforms must fully compensate consumers for their harm if consumers take adequate precautions $x \geq x^0$. If consumers do not take adequate precautions, $x < x^0$, then the platforms do not bear any liability.

[35] These assumptions ensure that the solutions are well-behaved.

Negligence Rule. Consider the negligence rule with the due-care level $e^N = e^0$. If a platform meets or exceed the standard e^0, its marginal cost is e^0. If the platform's care falls short of the due-care standard then its marginal cost is $e + \pi(e, x)d$ where x is the care level chosen by consumers.

It is not hard to see that the negligence rule motivates both the platforms and the consumers to take the socially-optimal care levels, e^0 and x^0. To see why this is an equilibrium, suppose that consumers are sophisticated and believe that the platforms will meet the due-care standard, e^0. Consumers understand that there is a risk $\pi(e^0, x)$ that they will suffer uncompensated harm $d > 0$, so their "full" price of joining the platforms is $p + x + \pi(e^0, x)$, which is minimized when $x = x^0$. So, a participating consumer will take effort $x = x^0$. Next, suppose that the platforms believe that consumers will choose effort x^0. The platforms' cost per consumer if they fall short of the due-care standard is $e + \pi(e, x^0)d$. Since this cost is minimized at e^0, and since $e^0 + \pi(e^0, x^0)d > e^0$, the platforms have an economic incentive to meet (but not exceed) the due-care standard.

Now consider the platforms' pricing decisions. Since the platforms are competitive, they will compete the prices down to $e^0 - \alpha$ or zero, whichever is larger

$$p^N = \max\{0, e^0 - \alpha\}. \tag{12}$$

As before, the price will be zero when the network effects α are large.

Finally, consider the consumers' participation incentives. A consumer with valuation $\widehat{v}$ is indifferent between participating and not if $\widehat{v} = p^N + x^0 + \pi(e^0, x^0)d$, where the right-hand side is the full price to the consumer of joining a platform. Since $p^N = \max\{0, e^0 - \alpha\}$ we have $v^N = \max\{0, e^0 - \alpha\} + x^0 + \pi(e^0, x^0)d$ or

$$v^N = \max\{x^0 + \pi(e^0, x^0)d, v^0\} \tag{13}$$

where v^0 is defined in (11). Notice that the participation threshold in (13) is always positive.

The consumers' private decisions to participate under the negligence rule may or may not be socially efficient. If the network effects are small, $\alpha \leq e^0$, then the negligence rule is socially efficient, $v^N = v^0$. If the network effects are large $\alpha > e^0$, however, the consumers' participation decisions under the negligence rule diverge from what is best for social welfare, $v^N > v^0$. In this case, the platforms charge the consumers $p = 0 > e^0 - \alpha$. Consequently, the full price that the consumers pay to join the platforms, $x^0 + \pi(e^0, x^0)d$, is larger than social cost, v^0, defined in (11). The consumers are not taking into account the positive externality that their participation creates for the platforms.

Strict Liability. Consider strict liability with compensatory damages $w = d$. Since consumers are sophisticated and know that they will be fully compensated for their harms, the consumers will not take precautions, $x^L = 0$. The platforms' marginal cost per consumer is $e + \pi(e, 0)d$. Therefore, the platforms choose e^L such that

$$\frac{\partial \pi(e^L, 0)}{\partial e} d + 1 = 0 \tag{14}$$

Platform competition will drive the price down to

$$p^L = \max\{0, e^L - \alpha + \pi(e^L, 0)d\}. \tag{15}$$

The consumers rationally anticipate that any future accident losses will be compensated in full by the platforms. A consumer with valuation $\widehat{v}$ is therefore indifferent between participating and not if $\widehat{v} - p^L = 0$. So, the participation threshold is

$$v^L = \max\{0, e^L - \alpha + \pi(e^L, 0)d\}. \tag{16}$$

Comparing (16) to (11) reveals that $v^L > v^0$. To see why, recall that e^0 and x^0 are chosen to minimize the social cost per consumer, $e + x + \pi(e, x)d$. Therefore it must be the case that $e^L + \pi(e^L, 0)d > e^0 + x^0 + \pi(e^0, x^0)d$. Inefficiency in consumer participation happens for two reasons. First, strict liability leads to distortions in the consumers' and the platforms' care levels, which may distort the consumers' participation incentives. Second, when the price is zero, as in the baseline model with unilateral care, the price that the consumers pay to join the platforms is larger than the social cost.

Strict Liability with Defense of Contributory Negligence. Suppose that platforms are held strictly liable with a defense of contributory negligence. If a consumer's effort x falls short of the due-care standard, x^0 defined in (10), then the platform is not liable for the consumer's losses. If the consumer's effort meets or exceeds the standard, $x \geq x^0$, then the platform must compensate the consumer for their loss, $w = d$.

With this rule, the platforms and consumers will take the socially-optimal levels of care e^0 and x^0 defined in (9) and (10). To see why this happens in equilibrium, suppose that consumers take due care x^0. The platforms' cost per consumer is $e + \pi(e, x^0)d$, which is minimized by $e = e^0$. Now suppose that the platforms take due care, e^0. If the consumers meet the due-care standard, the consumers are made whole following an accident so each consumer's full price of joining the platforms is $p + x^0$. If any consumer's effort falls short of the due-care standard, this consumer's full price is $p + x + \pi(e^0, x)d$. Since the full price is minimized at x^0, and since $p + x^0 + \pi(e^0, x^0)d > p + x^0$, the consumers will take due care. Similar to the negligence rule, strict liability with a defense of contributory negligence motivates both the platforms and the consumers to take the first-best care levels.

Next, consider the platforms' pricing and the consumers' participation decisions. Platform competition will drive the price down to

$$p^C = \max\{0, e^0 - \alpha + \pi(e^0, x^0)d\}. \tag{17}$$

If the network effects are large, $\alpha > e^0 + \pi(e^0, x^0)d$, then $p^C = 0$ and the platforms earn rents. The consumers rationally anticipate that any future accident losses will be compensated in full by the platforms. So, the participation threshold is $v^C = p^C + x^0$ and, using the formula for the price, $v^C = \max\{0, e^0 - \alpha + \pi(e^0, x^0)d\} + x^0$ or

$$v^C = \max\{x^0, v^0\} \tag{18}$$

where v^0 is defined in (11).

Compare the participation threshold in (18) to the socially-optimal threshold in (11). If $\alpha < e^0+\pi(e^0,x^0)d$, then the price in (17) is positive, $p^C > 0$, and the consumers' participation decision in (18) is efficient, $v^C = v^0$. The socially-optimal outcome is achieved. If $\alpha > e^0+\pi(e^0,x^0)d$ then the consumers' participation decision is insufficient, $v^C = x^0 > v^0$. Since the price in (17) is zero, as in the baseline model with unilateral care, the price that the consumers pay to join the platforms is larger than the social cost. The consumers do not take into account the full positive spillovers from their participation.

Social Welfare Analysis. We now compare the welfare effects. Consider three cases.

First, suppose $\alpha \leq e^0$. The earlier analysis implies that the negligence rule and strict liability with a defense of contributory negligence implement the first-best outcome while strict liability causes distortions in consumers' precautions. Therefore, strict liability is less efficient than the other two rules.

Second, suppose $\alpha \in (e^0, e^0 + \pi(e^0,x^0)d]$. The earlier analysis shows that strict liability with a defense of contributory negligence implements the first-best outcome. Strict liability distorts consumers' precaution incentives, and the negligence rule leads to socially insufficient participation ($v^N > v^0$). Therefore, strict liability with a defense of contributory negligence is more efficient than the other two rules.

Finally, suppose $\alpha > e^0 + \pi(e^0,x^0)d$. The negligence rule and strict liability with a defense of contributory negligence both induce the first-best care levels. Since $v^C = x^0 < v^N = x^0 + \pi(e^0,x^0)d$, strict liability with a defense of contributory negligence is more efficient than the negligence rule.

It remains to compare this rule to strict liability with compensatory damages. Social welfare under the two rules can be written as

$$S^L = \int_{v^L}^{\infty} [v + \alpha - (\pi(e^L,0)d + e^L)]f(v)dv \tag{19}$$

$$S^C = \int_{x^0}^{\infty} [v + \alpha - (\pi(e^0,x^0)d + e^0 + x^0)]f(v)dv \tag{20}$$

Notice that $v^L = \max\{0, e^L - \alpha + \pi(e^L,0)d\}$ defined in (16) decreases in α and is greater than x^0 when $\alpha = e^0 + \pi(e^0,x^0)d$.[36] Thus, $v^L \geq v^C = x^0$ if α is not too large and $v^L < v^C = x^0$ if otherwise.

If $v^L \geq x^0$, strict liability not only causes distortions in consumer precautions but also leads to less participation. Hence, strict liability with a defense of contributory negligence is more efficient.

If $v^L < x^0$, we have

$$\frac{dS^L}{d\alpha} = 1 - F(v^L) > 1 - F(x^0) = \frac{dS^C}{d\alpha} \tag{21}$$

Hence, there exists a unique threshold $\overline{\alpha} > e^0 + \pi(e^0,x^0)d$ such that $S^L < S^C$ if $\alpha < \overline{\alpha}$ and $S^L > S^C$ if $\alpha > \overline{\alpha}$.

[36] Given $\alpha = e^0 + \pi(e^0,x^0)d$, we have $v^L = e^L + \pi(e^L,0)d - \alpha > e^0 + x^0 + \pi(e^0,x^0)d - \alpha = x^0$.

To summarize, we have the following results.

Proposition 2. *(Bilateral Care) Suppose that there are competitive platforms and the consumers can also take precautions. The negligence rule with due-care standard $e^N = e^0$ and strict liability with a defense of contributory negligence with due care $x^C = x^0$ both lead to the socially-efficient care levels, $e^N = e^C = e^0$ and $x^N = x^C = x^0$, while strict liability leads to socially insufficient consumer precautions, $x^L = 0$.*

1. *If $\alpha \leq e^0$ then $v^0 = v^C = v^N$. The negligence rule and strict liability with a defense of contributory negligence lead to socially-efficient participation and are better than strict liability.*

2. *If $\alpha \in (e^0, e^0 + \pi(e^0, x^0)d]$ then $v^0 = v^C < v^N$. Strict liability with a defense of contributory negligence leads to socially-efficient participation and is better than the negligence rule and strict liability.*

3. *If $\alpha > e^0 + \pi(e^0, x^0)d$ then $v^0 < v^C < v^N$. None of the liability rules achieve the first-best outcome. There exists a unique threshold $\overline{\alpha} > e^0 + \pi(e^0, x^0)d$ such that*

   (a) *If $\alpha \leq \overline{\alpha}$ then strict liability with a defense of contributory negligence is better than the negligence rule and strict liability.*[37]

   (b) *If $\alpha > \overline{\alpha}$ then strict liability is better than the negligence rule and strict liability with a defense of contributory negligence.*

The result in case (1) resembles the observation in Shavell (1980).[38] With small network effects, the price p is positive under all the three rules and reflects the social cost. Since strict liability distorts consumers' precautions, the other two rules are better.

Different from the results in Shavell (1980), with larger network effects, the negligence rule and strict liability with a defense of contributory negligence are no longer equivalent in terms of total welfare effects. The price under the former rule becomes zero and leads to socially insufficient participation, while damage compensation under the latter rule stimulates participation.

Moreover, strict liability can be more efficient than the other two rules when network effects are large enough. Note that the "full" price paid by consumers under strict liability with a defense of contributory negligence is always positive given that consumers take precautions. By contrast, the "full" price under strict liability may become very small or even zero since consumers do not take precautions and still get full damage compensation. Thus, as compared to the rule with a defense of contributory negligence, strict liability causes distortions in care levels but may induce more participation. The former effect dominates when the network effects are medium and the latter one dominates when the network effects are sufficiently large.

[37] If $\alpha = \overline{\alpha}$ then strict liability with a defense of contributory negligence and strict liability are equivalent. Both are better than the negligence rule.

[38] See Table 2 in Shavell (1980).

3.2 Value Captured by Third Parties

There are many settings where liability is decoupled from compensation in the sense that the damages paid by the injurers are different from the amount of money received by the victims.[39] This may happen for a variety of reasons. In practice, government agencies (e.g., the Federal Trade Commission in the United States) often bring lawsuits on behalf of victims who are hard to identify. Some victims may be unaware that they are eligible for compensation, or may not know that they have even been harmed, so the settlement pools and damage awards may remain unclaimed. In class action lawsuits, the attorneys who bring the lawsuits on behalf of victims may capture considerable rents. In short, damages that are paid by the platforms may be captured by third parties (e.g., the government treasury, attorneys, and charities) rather than the victims themselves.

In this section, we will assume that the consumers and third parties share the damage award paid by the platforms. After a consumer suffered losses in an accident, the consumer gets partial compensation θd and the third parties get the remaining payments $(1-\theta)d$, where $\theta \in [0,1)$ is exogenously given. The surplus captured by the third parties is included in the social welfare function. Hence, the socially-optimal effort and participation are e^0 and v^0 defined in (2) and (3), respectively.

Negligence Rule. Under the negligence rule with due care standard $e^N = e^0$, the results are the same as in the baseline model. The platforms take the efficient care e^0 and consumers' participation threshold is $v^N = \max\{0, e^0 - \alpha\} + \pi(e^0)d$ or

$$v^N = \max\{\pi(e^0)d, v^0\}. \tag{22}$$

Strict Liability. Under strict liability with compensatory damages $w = d$, the platforms still exert effort e^0. As in the baseline model, platform competition drives the price down to

$$p^L = \max\{0, e^0 - \alpha + \pi(e^0)d\}. \tag{23}$$

However, consumers anticipate that they would receive less-than-full damage compensation, θd, after being harmed. Thus, a consumer with valuation $\widehat{v}$ is indifferent between participating and not if $\widehat{v} - p^L - (1-\theta)\pi(e^0)d = 0$. The participation threshold is $v^L = p^L + (1-\theta)\pi(e^0)d$ and using (23) this becomes

$$v^L = \max\{0, v^0\} + (1-\theta)\pi(e^0)d, \tag{24}$$

where v^0 is defined in (3). Notice that v^L in (24) is a decreasing function of θ. That is, larger compensation to the victims stimulates participation.[40]

If $\alpha \leq e^0 + \pi(e^0)d$, then $p^L \geq 0$ and $v^L = v^0 + (1-\theta)\pi(e^0)d > v^0$ given $\theta < 1$. Since consumers anticipate less-than-full damage compensation, their participation incentives are socially insufficient. Recall that, in the baseline model where harmed consumers

[39] See Polinsky and Che (1991) for an economic analysis of optimal decoupling.

[40] As $\theta \to 1$, v^L in (24) converges to the threshold defined in (7) in the baseline model.

receive full compensation under strict liability, if α is small, the participation incentives are socially efficient.

If $\alpha > e^0 + \pi(e^0)d$, then $p^L = 0$ and $v^L = (1-\theta)\pi(e^0)d > v^0$. The consumers' participation incentives are insufficient for two reasons. First, as in the baseline model, the platforms charge zero price, which does not reflect the social costs. Second, consumers anticipate less-than-full damage compensation, $\theta d < d$.

Social Welfare Analysis. Note that, if $\alpha \in (e^0, e^0+\pi(e^0)d]$, then $v^L = v^0+(1-\theta)\pi(e^0)d$ while $v^N = \pi(e^0)d$. In this case, $v^L > v^N$ when $\theta = 0$ and $v^L < v^N$ when $\theta = 1$. Thus, there exists a unique threshold $\widehat{\theta} \in (0,1)$ such that $v^N = v^L$ when $\theta = \widehat{\theta}$. Then we have the following results.

Proposition 3. *(Decoupled Liability) Suppose that there are competitive platforms. Fraction $\theta \in [0,1)$ of the damage award goes to the consumers and fraction $1-\theta$ goes to third parties. The negligence rule with due-care standard $e^N = e^0$ and strict liability with damage payments $w = d$ both lead to the socially-efficient platform safety, $e^N = e^L = e^0$, but differ in consumer participation.*

1. *If $\alpha \leq e^0$ then $v^L > v^N = v^0$. The negligence rule is better than strict liability.*
2. *If $\alpha \in (e^0, e^0 + \pi(e^0)d]$ then there exists a unique threshold $\widehat{\theta} \in (0,1)$ such that the negligence rule is better ($v^L > v^N > v^0$) when $\theta < \widehat{\theta}$ while strict liability is better ($v^N > v^L > v^0$) when $\theta > \widehat{\theta}$.*
3. *If $\alpha > e^0 + \pi(e^0)d$ then strict liability is better ($v^N > v^L > v^0$) when $\theta > 0$ and the two rules are equivalent ($v^N = v^L > v^0$) when $\theta = 0$.*

In case (1) of Proposition 3, with small network effects, the negligence rule implements the first-best outcome. Since the platforms meet the due-care standard, e^0, they do not pay damage awards. So, the allocation of the award between the consumers and third parties is immaterial. By contrast, strict liability induces the first-best platform safety but causes socially insufficient participation because harmed consumers do not receive full compensation ($\theta < 1$). Therefore, the negligence rule is more efficient.

In case (3), with large network effects, the equilibrium price is zero with both negligence and strict liability. The platforms get rents, and the consumers' participation incentives are socially insufficient. However, as long as the consumers receive some compensation ($\theta > 0$) under strict liability, the compensation reduces the "full" price for consumers and stimulates participation. In this case, strict liability is more efficient than the negligence rule.

In case (2), the network effects are in a middle range, so the equilibrium price is positive under strict liability but is zero under the negligence rule. If consumers anticipate sufficiently large damage compensation ($\theta > \widehat{\theta}$), as in the baseline model, the compensation reduces the "ful" price paid by consumers and stimulates participation, so that strict liability is more efficient. If consumers anticipate small damage compensation ($\theta < \widehat{\theta}$), their participation incentives under strict liability are even lower than under the negligence rule, so that the negligence rule is more efficient.

3.3 Monopoly Platform

The baseline model considers competitive platforms. In some markets, there is a dominant platform (e.g. Google in the search engine market). The welfare comparison between strict liability with compensatory damages $w = d$ and the negligence rule with $e^N = e^0$ are qualitatively similar when a monopoly platform sets the price. In this section, suppose that a monopoly platform sets price p. The other assumptions are the same as in the baseline model.

Negligence Rule. Suppose that liability is negligence-based with the due-care level equal to the socially-optimal level, $e^N = e^0$. As shown in the baseline model, the platform will take due care $e = e^0$ defined in (2).

Consumer type $\widehat{v}$ is indifferent between participating and not if $\widehat{v} = p + \pi(e^0)d$, so the platform will choose $p \geq 0$, or equivalently, $\widehat{v} \geq \pi(e^0)d$ to maximize profits

$$\int_{\widehat{v}}^{\infty} (\alpha + \widehat{v} - e^0 - \pi(e^0)d) f(v) dv. \tag{25}$$

The profit-maximizing solution, v^N, satisfies

$$v^N - \frac{1 - F(v^N)}{f(v^N)} = \max \left\{ \pi(e^0)d - \frac{1 - F(\pi(e^0)d)}{f(\pi(e^0)d)}, v^0 \right\}, \tag{26}$$

where $v^0 = e^0 - \alpha + \pi(e^0)d$ from (3) and v^N decreases in α.

If the network effects are small, $\alpha < e^0 + \frac{1-F(\pi(e^0)d)}{f(\pi(e^0)d)}$, then $p^N > 0$ and $v^N = v^0 + \frac{1-F(v^N)}{f(v^N)} > v^0$. The level of consumer participation is smaller than the first-best level because of the standard monopoly distortion. If the network effects are large, $\alpha > e^0 + \frac{1-F(\pi(e^0)d)}{f(\pi(e^0)d)}$, then $p^N = 0$ and $v^N = \pi(e^0)d > v^0$. Naturally, the consumers' participation incentives are socially insufficient in this case, too.

Strict Liability. Now, suppose that liability is strict with compensatory damages $w = d$. As shown in the baseline model, the platform exerts effort $e = e^0$. A consumer with valuation $\widehat{v}$ is indifferent between participating and not if $\widehat{v} - p = 0$. So, the platform will choose $p \geq 0$, or equivalently, $\widehat{v} \geq 0$ to maximize profits

$$\int_{\widehat{v}}^{\infty} (\alpha + \widehat{v} - e^0 - \pi(e^0)d) f(v) dv. \tag{27}$$

Using (3), the profit-maximizing solution, v^L, satisfies

$$v^L - \frac{1 - F(v^L)}{f(v^L)} = \max \left\{ -\frac{1 - F(0)}{f(0)}, v^0 \right\}, \tag{28}$$

which implies v^L decreases in α. The right-hand side of (28) is smaller than the right-hand side of (26). Strict liability stimulates participation, relative to the negligence rule.

If the network effects are small, $\alpha < e^0 + \pi(e^0)d + \frac{1-F(0)}{f(0)}$, then $p^L > 0$ and $v^L = v^0 + \frac{1-F(v^L)}{f(v^L)} > v^0$. If the network effects are large, $\alpha > e^0 + \pi(e^0)d + \frac{1-F(0)}{f(0)}$, then $p^L = 0$ and $v^L = 0 > v^0$. Thus, the consumers' participation incentives are socially insufficient in both cases.

Social Welfare Analysis. With a monopoly platform, the negligence rule and strict liability still induce the first-best care level, $e^N = e^L = e^0$. Similar to the baseline model with competitive platforms, here strict liability is (weakly) better because it leads to more consumer participation. Define

$$\alpha^L = e^0 + \pi(e^0)d + \frac{1 - F(0)}{f(0)} \tag{29}$$

and

$$\alpha^N = e^0 + \frac{1 - F(\pi(e^0)d)}{f(\pi(e^0)d)}. \tag{30}$$

Since $(1 - F(v))/f(v)$ is a decreasing function of v by assumption, we have $\alpha^L > \alpha^N$.

Proposition 4. *Suppose that there is a monopoly platform which can take unilateral care. The negligence rule with due-care standard $e^N = e^0$ and strict liability with compensatory damages $w = d$ both lead to the socially-efficient platform safety, $e^N = e^L = e^0$, but differ in consumer participation.*

1. *If $\alpha \leq \alpha^N$ then $v^N = v^L > v^0$. The negligence rule and strict liability are equivalent and lead to socially-insufficient participation.*

2. *If $\alpha > \alpha^N$, then $v^N > v^L > v^0$. Both rules lead to socially-insufficient participation. Strict liability is better than the negligence rule.*

When network effects are small (case (1)), the platform sets a positive price and the two liability rules are equivalent. When network effects are large (case (2)), however, strict liability is more efficient, because the damage payment reduces the "full" price paid by consumers and stimulates participation.

4 Conclusion

This paper explored whether platform liability should be strict or negligence-based. We explored the issues in a parsimonious model of two-sided platforms that obtained revenue from selling products or services to consumers and selling advertising (or information) to others. There was a moral hazard problem in the sense that the platforms' safety measures were not directly observed by consumers when they decide to join the platforms. We showed that if the network effects are weak then both strict liability and negligence lead to efficient precautions and consumer participation. If network effects are strong,

then strict liability stimulates more user participation and higher social welfare than the negligence rule.

The insights in this paper may be applied and extended to the design of safety regulation. Safety regulation is similar to negligence liability in that platforms are exposed to financial penalties if they deviate from the standard of care. With regulation, the standard of care is set by lawmakers (i.e., the legislative branch in the US or through delegation to administrative agencies). With litigation, the due-care standard may be determined by the courts. One important difference is that, with regulation, the platform would be fined for violating a regulation *regardless* of whether consumers have suffered harms. With liability, legal action is brought only after the harm has occurred. It would be interesting to explore the advantages, disadvantages, and interactions between the two approaches.

References

[1] Arlen, Jennifer, and W. Bentley MacLeod, "Malpractice Liability for Physicians and Managed Care Organizations," *New York University Law Review*, Vol. 78 (2003), pp. 1929-2006.

[2] Arlen, Jennifer, and W. Bentley MacLeod, "Torts, Expertise, and Authority: Liability of Physicians and Managed Care Organization," *RAND Journal of Economics*, Vol. 36 (2005), pp. 494-515.

[3] Armstrong, Mark, "Competition in Two-sided Markets," *RAND Journal of Economics*, Vol. 37 (2006), pp. 668-691.

[4] Armstrong, Mark and Julian Wright, "Two-Sided Markets, Competitive Bottlenecks, and Exclusive Contracts," *Economic Theory*, Vol. 32 (2007), pp. 353-380.

[5] Bebchuk, Lucian and Jesse Fried, "The Uneasy Case for the Priority of Secured Claims in Bankruptcy," *Yale Law Journal*, Vol. 105 (1996), pp. 857-934.

[6] Belleflamme, Paul and Martin Peitz, *The Economics of Platforms*, Cambridge University Press, 2021.

[7] Boyer, Marcel, and Jean-Jacques Laffont, "Environmental Risk and Bank Liability," *European Economic Review*, Vol. 41 (1997), pp. 1427-1459.

[8] Buiten, Miriam C., Alexandre de Streel, and Martin Peitz, "Rethinking Liability Rules for Online Hosting Platforms," *International Journal of Law and Information Technology*, Vol. 28 (2020), pp. 139-166.

[9] Caillaud, Bernard, and Bruno Jullien, "Chicken & Egg: Competition among Intermediation Service Providers," *RAND Journal of Economics*, Vol. 34 (2003), pp. 309-328.

[10] Chen, Yongmin, and Xinyu Hua, "Ex ante Investment, Ex post Remedies, and Product Liability," *International Economic Review*, Vol 53 (2012), pp. 845-866.

[11] Chen, Yongmin, and Xinyu Hua, "Competition, Product Safety, and Product Liability," *Journal of Law, Economics, & Organization*, Vol. 33 (2017), pp. 237-267.

[12] Choi, Albert, and Kathryn E. Spier, "Should Consumers Be Permitted to Waive Products Liability? Product Safety, Private Contracts, and Adverse Selection," *Journal of Law, Economics, & Organization*, Vol. 30 (2014), pp. 734-766.

[13] Choi, Jay Pil, and Doh-Shin Jeon, "A Leverage Theory of Tying in Two-sided Markets with Nonnegative Price Constraints," *Americal Economic Journal: Microeconoimcs*, Vol. 13 (2021), pp. 283-337.

[14] Choi, Jay Pil, and Arijit Mukherjee, "Optimal Certification Policy, Entry, and Investment in the Presence of Public Signals," *RAND Journal of Economics*, Vol. 51 (2020), pp. 989-1013.

[15] Cooper, James C., and Bruce H. Kobayashi, "Unreasonable: A Strict Liability Solution to FTC's Data Security Problem," *Michigan Technology Law Review*, Vol. 28 (2022).

[16] Daughety, Andrew F., and Jennifer F. Reinganum, "Product Safety: Liability, R&D, and Signaling," *American Economic Review,* Vol. 85 (1995), pp. 1187-1206.

[17] Dari Mattiacci, Giuseppe, and Francesco Parisi, "The Cost of Delegated Control: Vicarious Liability, Secondary Liability and Mandatory Insurance," *International Review of Law and Economics*, Vol. 23 (2003), pp. 453-475.

[18] Epple, Dennis, and Artur Raviv, "Product Safety: Liability Rules, Market Structure, and Imperfect Information," *American Economic Review*, Vol. 68 (1978), pp. 80-95.

[19] Gans, Joshua S., "The Specialness of Zero," *Journal of Law and Economics*, Vol. 65 (2022), pp. 157-176.

[20] Hagiu, Andrei, "Pricing and Commitment by Two-Sided Platforms," *RAND Journal of Economics*, Vol. 37 (2006), pp. 720-737.

[21] Hagiu, Andrei, "Quantity vs. Quality and Exclusion by Two-Sided Platforms," (2009), working paper.

[22] Hagiu, Andrei, and Julian Wright, "Marketplace or Reseller?" *Management Science*, Vol. 61 (2015), pp. 184-203.

[23] Hagiu, Andrei, and Julian Wright, "Controlling vs. Enabling," *Management Science*, Vol. 65 (2018), pp. 577-595.

[24] Hamada, Koichi, "Liability Rules and Income Distribution in Product Liability." *American Economic Review*, Vol. 66 (1976), pp. 228-234.

[25] Hamdani, Assaf, "Who is Liable for Cyberwrongs?" *Cornell Law Review*, Vol. 87 (2002), pp. 901-957.

[26] Hamdani, Assaf, "Gatekeeper Liability," *Southern California Law Review*, Vol. 77 (2003), pp. 53-122.

[27] Hay, Bruce, and Kathryn E. Spier, "Manufacturer Liability for Harms Caused by Consumers to Others," *American Economic Review*, Vol.95 (2005), pp. 1700-1711.

[28] Hua, Xinyu and Kathryn E. Spier, "Product Safety, Contracts, and Liability," *RAND Journal of Economics*, Vol. 51 (2020), pp. 233-259.

[29] Hua, Xinyu and Kathryn E. Spier, "Holding Platforms Liable," working paper (2022).

[30] Jeon, Doh-Shin, Yassine Lefouili, and Leonardo Madio, "Platform Liability and Innovation," working paper, 2022.

[31] Julien, Bruno, and Alessandro Pavan, "Information Management and Pricing in Platform Markets," *Review of Economic Studies*, Vol. 86 (2019), pp. 1666-1703.

[32] Kraakman, Reinier H., "Gatekeepers: The Anatomy of a Third-Party Enforcement Strategy," *Journal of Law, Economics, & Organization*, Vol. 2 (1986), pp. 53-104.

[33] Karle, Heiko, Martin Peitz, and Markus Reisinger, "Segmentation versus Agglomeration: Competition between Platforms with Competitive Sellers," *Journal of Political Economy*, Vol. 128 (2020), pp. 2329-2374.

[34] Lefouili, Yassine, and Leonardo Madio, "The Economics of Platform Liability," *European Journal of Law and Economics*, Vol. 53 (2022), pp. 319-351.

[35] Oi, Walter Y., "The Economics of Product Safety." *Bell Journal of Economics and Managment Science*, Vol. 4 (1973), pp. 3-28.

[36] Pitchford, Rohan, "How Liable Should a Lender Be? The Case of Judgment-Proof Firms and Environment Risk," *American Economic Review*, Vol. 85 (1995), pp. 1171-1186.

[37] Polinsky, A. Mitchell and Yeon-Koo Che, "Decoupling Liability: Optimal Incentives for Care and Litigation." *RAND Journal of Economics*, Vol. 22 (1991), pp. 562-570.

[38] Polinsky, A. Mitchell and William P. Rogerson, "Products Liability, Consumer Misperceptions, and Market Power." *Bell Journal of Economics*, Vol. 14 (1983), pp. 581-589.

[39] Rochet, Jean-Charles, and Jean Tirole, "Platform Competition in Two-Sided Markets," *Journal of the European Economic Association*, Vol. 1 (2003), pp. 990-1029.

[40] Rochet, Jean-Charles, and Jean Tirole, "Two-Sided Markets: A Progress Report," *RAND Journal of Economics*, Vol. 37 (2006), pp. 645-667.

[41] Simon, Marilyn J, "Imperfect Information, Costly Litigation, and Product Quality," *Bell Journal of Economics*, Vol. 12 (1981), pp. 171-184.

[42] Shavell, Steven, "Strict Liability Versus Negligence," *Journal of Legal Studies*, Vol. 9 (1980), pp. 1-25.

[43] Shavell, Steven, "Liability for Accidents," Chapter 2, Handbook of Law and Economics (2007), Elsevier.

[44] Spence, A. Michael, "Consumer Misperceptions, Product Failure, and Producer Liability," *Review of Economic Studies*, Vol. 44 (1977), pp. 561-572.

[45] Teh, Tat-How, "Platform Governance," *American Economic Journal: Microeconomics*, Vol. 14 (2022), pp. 213-254.

[46] Van Loo, Rory, "The New Gatekeepers: Private Firms as Public Enforcers," *Virginia Law Review*, Vol. 106 (2020a), pp. 467-522.

[47] Van Loo, Rory, "The Revival of Respondeat Superior and Evolution of Gatekeeper Liability," *Georgetown Law Journal*, Vol. 109 (2020b), pp. 141-189.

[48] Weyl, Glen, "A Price Theory of Multi-Sided Platforms," *American Economic Review*, Vol. 100 (2010), pp. 1642-1672.

[49] Wickelgren, Abraham L., "The Inefficiency of Contractually Based Liability with Rational Consumers," *Journal of Law, Economics, & Organization*, Vol. 22 (2006), pp. 168-183.