

Article

Not peer-reviewed version

---

# Consumer Information Disclosing Strategy within Consumer Misrepresentation

---

[Mingyue Zhong](#), [Yan Cheng](#), [Shu-e Mei](#)<sup>\*</sup>, Weijun Zhong

Posted Date: 11 March 2024

doi: 10.20944/preprints202403.0612.v1

Keywords: misrepresentation; privacy protection behavior; information disclose; personalized service



Preprints.org is a free multidiscipline platform providing preprint service that is dedicated to making early versions of research outputs permanently available and citable. Preprints posted at Preprints.org appear in Web of Science, Crossref, Google Scholar, Scilit, Europe PMC.

Copyright: This is an open access article distributed under the Creative Commons Attribution License which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Article

# Consumer Information Disclosing Strategy within Consumer Misrepresentation

Mingyue Zhong <sup>1</sup>, Yan Cheng <sup>2</sup>, Shu-e Mei <sup>1,\*</sup> and Weijun Zhong <sup>1</sup>

<sup>1</sup> School of Economics and Management, Southeast University, Nanjing, 210096, China; zhongmingyue@seu.edu.cn (M. Z.); zhongweijun@seu.edu.cn (W. Z.)

<sup>2</sup> Department of Economics and Management, Jiangsu Institute of Administration, Nanjing, 210009, China; meganchyan@hotmail.com

\* Correspondence: meishue@seu.edu.cn

**Abstract:** To decrease privacy risks, consumers may choose to misrepresent when they are asked to offer personal information. This paper examines the impact of consumer misrepresentation on a monopolistic firm and consumers with an economic model. The results show that consumer misrepresentation may benefit the firm but hurt consumers. In addition, consumers misrepresentation may encourage the firm to provide higher personalized service level in certain scenarios, such as, when the unit cost of personalized service is low. Thirdly, when consumers misrepresent, and the firm only covers part of the market, a greater unit value of consumer's privacy information will reduce the firm's profit, but a greater unit cost of personalized service increases the firm's profit.

**Keywords:** misrepresentation; privacy protection behavior; information disclose; personalized service

## 1. Introduction

Electronic commerce technology helps firms to collect consumer personal information, such as personal identification information, browsing records, purchasing records and so on. With the information, firms can recognize potential consumers and set targeted marketing strategies. As a return for providing privacy information, consumers can get extra price discount and personalized services from the firms. However, when disclosing personal information, consumers may endure privacy risk from illegal information collection, unauthorized access [1–4]. In order to decrease privacy risk, some consumers misrepresent when realizing firms' information collecting behavior. Typically, consumers provide false personal information or fake behavior records intentionally. For example, consumers provide false personal information during registering. And they may provide behavior information that referring to the wrong preference by browsing the products that they are not interested in. Moreover, consumers may change their IP address or geographic information with privacy protection software. A few of studies [5–7] showed that misrepresentation is one of the main methods taken by internet consumers to protect personal information. Hence, personal information that firm may get can be separated into two parts, true personal information and false personal information. To simplify the expression of true personal information and false personal information, in the rest of the paper, "privacy information" refers to "true personal information", "false information" refers to "false personal information".

But some consumers prefer to provide true personal information for a return of personalized service [8–12], and they believe that misrepresentation by providing false information will reduce their personalized service. For example, when a consumer provides false information, she may receive unrelative targeted advertising based on her provided false information. The consumer can't get her wanted information via advertising and may be bothered by the unrelative advertising. Obviously, misrepresentation is a double-edged sword for consumers. Consumers need to decide whether to misrepresent or not.

Misrepresentation also influences on the firms. On the one hand, it may impact on the firms' personalized service on consumers negatively. Consumers' misrepresentation with false information may mislead firms. Firstly, firms are harder to recognize potential consumers, they may miss the consumers with demand or choose the consumers without demand. Secondly, firms may provide inaccurate personalized services with the false information, such as providing inaccurate discount. On the other hand, misrepresentation may impact on the firms positively. False information can decrease consumers' privacy risk, more consumers may participate in the market, and firms may get more demand and profits. Apparently, misrepresentation might be good for the firms even it reduces firms' personalized service. Therefore, firms need to set their personal service strategy depending on consumers' misrepresentation.

Motivated by the contradict impacts of misrepresentation on both consumers and firms, this paper aims to answer the following research questions: How does misrepresentation impact on consumers and firms? Under what conditions do consumers benefit from misrepresentation? How do the firms set their personalized service strategy considering consumers' misrepresentation?

We develop a game-theoretic approach to examine how consumers' misrepresentation impacts on a monopolistic firm's personalized service strategy. Three equilibrium outcomes are derived. Firstly, we find that consumers' misrepresentation is not always bad for the firm and not always good for consumers correspondingly. This finding is different from the institution that misrepresentation can always benefit consumers and hurt the firm. Secondly, we conclude that consumers' misrepresentation may not decrease the firm's personalized service level, the firm may provide higher personalized service level when the unit cost of personalized service is low. Finally, we conclude that when consumers misrepresent, and the market is partly covered, the increasing unit value of consumer's privacy information has a negative impact on the firm's profit, but the increasing unit cost of personalized service has a positive impact on the firm's profit.

The rest of the paper is organized as follows. Section 2 reviews related literature. Section 3 introduces our baseline model. Section 4 analyses the impact of misrepresentation on consumers' information disclosing decisions and the firm's personalized service strategy. The conclusions and limitations of the paper are given in Section 5.

## 2. Literature Review

Our work discusses the impact of consumers' misrepresentation on consumers and firms. Three streams of existing literatures are particularly relative with our study --- literatures on consumers' privacy protection behaviours (for short, PPBs), firms' reaction on consumers' privacy concerns and personalized service strategy with consumers disclosing privacy information.

### 2.1. Consumers' Privacy Protection Behaviours (PPBs)

A series of literatures [1,13,14] discussed how consumers adapt PPBs to protect their privacy information. Alkire et al. [13] concluded that common PPBs include "Reflection, Avoidance, Intervention, Restriction, Control and Restraint". Son and Kim [6] pointed out that there are six types of consumer's behavioural responses, including refusal, misrepresentation, removal, negative word-of-mouth, complaining directly to online companies, and complaining indirectly to third-party organizations. Chen and Rea [15], Sannon et al. [16] presented that falsification of personal information, passive reaction and identity modification are three typical privacy control methods. Furthermore, several analytical papers tried to find out the factors influencing consumers' PPBs. Adhikari and Panda [17] found that consumers' privacy concerns have significant influence on their PPBs. Meanwhile, PPBs can further influence consumers' privacy concerns [18]. Kruikemeier et al. [19] studied who are more likely to adapt PPBs via a representative two-wave panel survey, they found that consumers with higher privacy concerns are more likely to adapt PPBs. In addition, "knowledge of and concern regarding technology ubiquity" and "companies' business strategies" can also affect consumers' PPBs [20].

Misrepresentation is a common PPBs, and has been studied the mechanism in economics and marketing [21–25]. Church et al. [21] discussed the mechanism that how competition and altruism impact online disclosure behaviors considering user misrepresentation. Drouvelis et al. [22] found that consumers' misrepresentation may result in large losses. Kumar et al. [24] concluded that the internet makes it easy for people to misrepresent their privacy information. Wirtz et al. [25] hypothesized that "the greater the consumer's privacy concern, the greater is the likelihood of the consumer to misrepresent and fabricate personal information" and demonstrated with a survey. Karl and Peluchette [26] found that many Facebook users misrepresent themselves intentionally.

The existing literatures focused on the mechanism of PPBs and the impact of PPBs on firms and consumers. Some of these literatures discussed why consumers misrepresent. Differ from the existing literatures, we considered the relationship between misrepresentation and firm's personalized service strategy. Furthermore, we considered the double-edged sword of misrepresentation simultaneously which is seldomly considered but exists in practice.

## *2.2. Reactions of the Firms to Consumers' Privacy Concerns*

Consumers' privacy concerns impact on consumers' purchase decisions, firms should take actions according to the existence of consumers' privacy concern. Several literatures investigated the relationship between firms' reactions and consumers' privacy concerns. Ariffin et al. [27] found that consumers may not be willing to disclose privacy information or purchase from the firms who ask for their privacy information, due to their privacy concerns. Industry self-regulation, government regulation, and individual self-protections are considered to be the important measures to decrease consumer privacy concerns [28]. Firms can also take reactions to reduce consumers' privacy concern. Privacy statement and privacy seals are two typical forms of PPBs of the firms, but the mechanisms are different, privacy statement induces users to disclose privacy information whereas privacy seals do not induce users to disclose privacy information [29,30]. In addition, privacy regulations influence on firms' reactions. Kaul [31] investigated the importance of firms' privacy regulations on consumers. Miller and Tucker [32] found that stating privacy regulation reduces firms' adoption of Electronic Medical Records (EMRs). Goldfarb and Tucker [33] studied the relationship between the privacy regulations and targeted advertising based on consumers' privacy information, the findings indicated that targeted advertisement become less effected with EU privacy regulations. A very little literatures studied the impact of firms' privacy protections on firms' competition. Lee et al. [34] showed that privacy protection can mitigate competition if one firm protects user privacy and the other does not.

Existing literatures analyzed the relationship between firms' personalized service strategy and consumers' privacy concerns. But most of the literatures just listed the possible measures that individuals may take, few literatures studied the effect of consumer self-protection on consumers or firms which is discussed in this paper.

## *2.3. Personalized Service Strategy*

The relationship between personalized service and consumers' disclosing privacy information has been discussed [35–39]. Firms' personalized service is considered to encourage consumers to engage online [37,39]. Meanwhile, Hann et al. [40] found that personalized service benefits both consumer and firms, and it encourages consumers to disclose their privacy information. Chellappa and Sin [41] designed an experiment and concluded that personalized service makes consumers more willing to purchase. But Karwatzki et al. [36] concluded that when firms provide personalized service based on consumers' disclosing privacy information, they benefit only when consumers' privacy concern is not high. Sutanto et al. [42] studied the relationship between mobile targeted advertising and mobile phone users' reactions, they found that users save advertising messages more frequently only when their privacy information is well protected.

Furthermore, several literature [43,44] investigated how consumer privacy concerns impact firms' personalized service strategy. Chellappa and Shivendu [41] examined vendor personalized

strategies in a market where consumers have heterogeneous privacy concern. They found that firms take different personalized strategies depending on the vendor's marginal value of information and consumer privacy concern. Moreover, consumer personal information provision quantity determines personalization investment. Chellappa and Shivendu [45] concluded that the amount of information is given, firms can determine personalized service level. Casadesus-Masanell and Hervás-Drane [46] implied that personalized service quality is concave in the amount of consumers' privacy information provision.

These above-mentioned literatures mostly studied how firms choose their personalized service strategy depending on consumers' disclosing privacy information, few literatures studying the relationship between consumers' PPBs and firms' personalized service strategy. We complement this stream of literatures and enrich our understanding of the firms and consumers' interaction considering consumers' misrepresentation and firms' personalized service.

### 3. Model Description

We consider a monopolistic firm selling product to potential consumers in a unit mature market. To simplify the analysis, in this paper the marginal product cost is normalized to zero, and the firm and consumers are risk-neutral.

Consumers buy products from the firm with a given price  $p$ , which is exogenous. But their perceived values are different but uniformly distributed in the interval  $[0,1]$ , we assume that consumer  $i$ 's perceived value of the product is  $\theta_i$ . is  $I, (I \in [0,1])$  and consumers will feel privacy risk. Following Kang et al. [47], we assume that consumers' perceived privacy risk is  $I^2$ . To decrease their privacy risk, consumers choose to misrepresent. Assume that consumers provide privacy information is  $k$ , that is, the false information the consumers misrepresent equals to  $1 - k$ . Hence, consumer's perceived privacy risk is  $k^2$ . On the other hand, disclosing privacy information can help consumers to get personalized service. And consumers can get additional perceived value  $ek$  with personalized service, where  $e$  shows the firm's personalized service technology investment effort. To simplify the analysis, we assume the cost of misrepresentation is zero. So, consumer  $i$ 's utility when she misrepresents can be given as:

$$u_i = \theta_i + ek - k^2 - p \quad (1)$$

The monopolistic firm collect consumers' information when consumers shopping on her website. She collects consumers' personal information to provide personalized service and get additional revenues. In Awad and Krishnan [48], firm's personalized service increases consumers' utility when consumers buy from the firm. Following Chellappa and Shivendu [45], the firm can provide different personalized service level  $e$ . The firm should invest to improve the personalized service level, referring to Chellappa and Shivendu [45], we assume the cost on personalized service is  $\beta e^2$ , where  $\beta$  is the unit cost of personalized service. Except for the personalized service, the firm can get additional profit by analyzing these data. For example, the firm can recommend complement goods of the product to the consumers and gets extra profit in the future. Hence, a lot of Internet firms treasure consumers' privacy information even they are not using the information. But only consumers' privacy information is profitable for the firm. Following Chellappa and Shivendu [45], we assume that the additional profit the firm can get from consumer's privacy information is  $\alpha k$ , where  $\alpha$  represents the unit value of the collected real consumer information. When the firm collects  $n$  consumers' personal information, the firm's expected profit function is given as follows:

$$\pi = (p + \alpha k)n - \beta e^2 \quad (2)$$

The timing sequence of the game in this paper includes three periods. In the first period, the firm chooses her personalized service level  $e$ , then consumers who receive the personalized service make their purchase decisions. In the third stage, the consumers who decide to buy from the firm set their misrepresentation decisions. The descriptions of the variables are presented in Table 1.

**Table 1.** Description of Variables.

Variable	Definition
$\theta_i$	Perceived product value of consumer $i$
$p$	Price of the product
$\alpha$	Unit value of consumer's privacy information
$e$	personalized service level
$k$	Proportion of privacy information
$\beta$	Unit cost of personalized service
$I$	Consumer's personal information that the firm collects

#### 4. Equilibrium Analysis

In this section, we firstly analyze the benchmark case where the monopolistic firm and consumers make decision without misrepresentation and then examine the misrepresentation case where the monopolistic firm and consumers make decisions with misrepresentation. Finally, we investigate the effect of misrepresentation on the monopolistic firm and consumers. To distinguish the two cases, we adopt different superscriptions  $B$  and  $F$  to describe the benchmark case and the misrepresentation case.

##### 4.1. Firm's Personalized Service Efforts and Consumers' Purchasing Behaviour without Misrepresentation

We firstly analyze the case that consumers do not misrepresent, that is, all of the personal information the firm collected is consumers' privacy information ( $k = 1$ ). With backward induction, we firstly derive the expected demand in the market.

Consumers buy from the firm if their utility is not less than zero, that is,  $u_B \geq 0$ . Hence, the expected demand in the market is given as follows:

$$n_u^B = \begin{cases} 1, & e^B \geq 1 + p \\ e^B - p, & e^B < 1 + p \end{cases} \quad (3)$$

In Equation (3), all consumers in the market will buy from the firm when the personalized service level is greater than  $1 + p$ . Otherwise, only part of consumers whose perceived utility is greater than zero buys from the firm.

Following the upper-mentioned timing sequence, with backward induction, the monopolistic firm sets her personalized service level to maximize her expected profit. We substitute Equation (3) into Equation (2), with F.O.C, we can derive the equilibrium solutions as follows.

**Proposition 1.** *If consumers do not misrepresent, the monopolistic firm's optimal personalized service level is*

$$e^{B*} = \begin{cases} 1 + p, & \beta \leq \frac{p + \alpha}{2(1 + p)} \\ \frac{p + \alpha}{2\beta}, & \beta > \frac{p + \alpha}{2(1 + p)} \end{cases}, \text{ correspondingly, the expected demand and expected profit of the monopolistic firm}$$

are

$$(n^{B*}, \pi^{B*}) = \begin{cases} (1, p + \alpha - \beta(1 + p)^2), & \beta \leq \frac{p + \alpha}{2(1 + p)} \\ \left( \frac{p + \alpha}{2\beta} - p, \frac{(p + \alpha)(p + \alpha - 4\beta p)}{4\beta} \right), & \beta > \frac{p + \alpha}{2(1 + p)} \end{cases}$$

Proposition 1 shows the monopolistic firm's optimal personalized service level, expected demand and profit when consumers don't misrepresent. As in Equation (3), if the firm provides personalized service level is not less than  $1 + p$ , all consumers will buy from the firm, hence the expected demand equals to 1. If the firm provides her personalized service level greater than 1, her expected profit will decrease, hence, the optimal personalized service level is  $1 + p$  when all consumers buy from the firm. When the firm offers personalized service level is less than  $1 + p$ , some of the consumers will choose not to buy, the expected profit may decrease. With a given personalized

service level, the expected demand equals to  $e^B - p$ , with F.O.C of the firm's profit function, we derive the optimal personalized service level is  $\frac{p+\alpha}{2\beta}$ .

The intuition is as follows. When the unit cost of personalized service level is low, it means that the marginal expected profit is great, offering a greater personalized service level can help the firm to cover the whole market and get more profit. But when the unit cost of personalized service level is high, the marginal expected profit decreases. To maximize her expected profit, the firm need to decrease her service level, and only some of the consumers will buy from the firm.

Hence, the monopolistic firms should choose her personalized service level strategy depending on the unit cost of the unit cost of personalized service. When the unit cost of personalized service is low, she should set a personalized service level equals to  $1 + p$  and covers the whole market. Otherwise, she should decrease her personalized service level to maximize her expected profit, which results to the scenario where only part of consumers are covered with the firms' personalized service.

Corollary 1 is derived from Proposition 1 and summarizes how the product price, unit value of consumer's privacy information and the unit cost of personalized service impact on the firm's optimal personalized service level, demand and expected profit. To make the expression in the rest of the paper clearer, we define that if  $n^{B*} = 1$ , the market is fully covered; otherwise, the market is partly covered.

**Corollary 1.** If consumers do not misrepresent,

(1) When the market is fully covered, (i)  $\frac{de^{B*}}{dp} > 0$ ; (ii) if  $\alpha < 1$ ,  $\frac{d\pi^{B*}}{dp} < 0$ ; if  $\alpha > 1$  &  $\beta > \frac{1}{2}$ ,  $\frac{d\pi^{B*}}{dp} < 0$ ; if  $\alpha > 1$  &  $\beta < \frac{1}{2}$ , when  $p < \frac{1}{2\beta} - 1$ ,  $\frac{d\pi^{B*}}{dp} > 0$ , otherwise,  $\frac{d\pi^{B*}}{dp} < 0$ .

(2) When the market is partly covered, (i)  $\frac{de^{B*}}{dp} > 0$ ; (ii) if  $\beta > \frac{1}{2}$ ,  $\frac{dn^{B*}}{dp} < 0$ , otherwise,  $\frac{dn^{B*}}{dp} > 0$ ; (iii) if  $\beta < \frac{1}{4}$ ,  $\frac{d\pi^{B*}}{dp} > 0$ ; if  $\frac{1}{4} < \beta < \frac{1}{2}$ , when  $p < \frac{2\beta-1}{1-4\beta}\alpha$ ,  $\frac{d\pi^{B*}}{dp} > 0$ , otherwise,  $\frac{d\pi^{B*}}{dp} < 0$ ; if  $\beta > \frac{1}{2}$ ,  $\frac{d\pi^{B*}}{dp} < 0$ .

Corollary 1 shows how the relationship between the product price and the firm's optimal personalized service level, demand and expected profit. It is clear that an increasing product price encourages the firm to provide greater personalized service level under two cases. Because the firm can get more marginal profit with greater personalized service level. But the relationship between the product price and the demand and the expected profit varies with parameter  $\alpha$  and  $\beta$  in the two different cases. In Corollary 1 (1), it is interesting that when the market is fully covered, a greater product price may decrease the firm's expected profit even the unit value of consumer privacy information is high. When the unit value of consumer privacy information  $\alpha$  is low, no matter the unit cost of personalized service  $\beta$  changes, the expected profit always decreases in price. Because when  $\alpha$  is low, it means the expected additional profit is low, but the cost of personalized service increases, it leads to a decreasing marginal profit, hence, the expected profit decreases in price. Similarly, when  $\alpha > 1$  &  $\beta > \frac{1}{2}$ , the marginal expected profit decreases with the increasing price. But when  $\alpha > 1$  &  $\beta < \frac{1}{2}$ , it represents that the unit value of consumer privacy information  $\alpha$  is high, meanwhile the unit cost of personalized service  $\beta$  is low, if the product price is lower than  $\frac{1}{2\beta} - 1$ , the expected profit increases in  $p$ , because in this scenario, the marginal expected profit increases with  $p$  and always greater than zero, the firm always gets more profit with an increasing product price. But if the product price is greater than  $\frac{1}{2\beta} - 1$ , the personalized service cost increases which decreases the marginal expected profit and the marginal expected profit is always less than zero.

When the market is partly covered, the increasing product price impacts on the expected demand differently. When the unit cost of personalized service is high ( $\beta > \frac{1}{2}$ ), the marginal expected profit is always less than zero, and decreases with an increasing product price. To maximize her profit, the firm should reduce her personalized service level until the marginal expected profit equals to zero. A lower personalized service level leads to a less demand. Oppositely, when the unit cost of personalized service is low ( $\beta < \frac{1}{2}$ ), the firm should increase her personalized service level to cover

more consumers until the marginal expected profit equals to zero. When the firm increases her personalized service level, the expected demand increases. Similar with the analysis in the case where all consumers are covered, we can derive the relationship between the product price and the expected profit. But in Corollary 1, when the unit cost of personalized service is in the middle range ( $\frac{1}{4} < \beta < \frac{1}{2}$ ), the expected profit firstly increases and then decreases in the product price, and the trend is different with the trend of the demand. That is, if  $p > \frac{2\beta-1}{1-4\beta}\alpha$ , the firm gets more demand but less profit with an increasing product price. The reason is an increasing  $p$  increases the firm's personalized service level, but increases the cost of personalized service, when  $p > \frac{2\beta-1}{1-4\beta}\alpha$ , the marginal expected profit is less than zero and decreases in  $p$ .

Corollary 1 indicates that if the firm increases her product price, she should provide higher personalized service level correspondingly. Meanwhile, the firm should not increase her product price blindly, only in the scenario where the unit value of consumer privacy information is high and the unit cost of personalized service is low, an increasing product price can help her to get more profit.

Based on Proposition 1, we can derive the following corollary.

**Corollary 2.** If consumers do not misrepresent,

(1) When the market is fully covered, (i)  $\frac{de^{B^*}}{d\alpha} = 0; \frac{d\pi^{B^*}}{d\alpha} > 0$ . (ii)  $\frac{de^{B^*}}{d\beta} = 0; \frac{d\pi^{B^*}}{d\beta} < 0$ .

(2) When the market is partly covered, (i)  $\frac{de^{B^*}}{d\alpha} > 0; \frac{d\pi^{B^*}}{d\alpha} > 0$ ; if  $\beta \leq \frac{1}{2}$ ,  $\frac{d\pi^{B^*}}{d\alpha} > 0$ ; if  $\beta > \frac{1}{2}$ , when  $\alpha < (2\beta - 1)p$ ,  $\frac{d\pi^{B^*}}{d\alpha} < 0$ , when  $\alpha > (2\beta - 1)p$ ,  $\frac{d\pi^{B^*}}{d\alpha} > 0$ . (ii)  $\frac{de^{B^*}}{d\beta} < 0, \frac{d\pi^{B^*}}{d\beta} < 0, \frac{d\pi^{B^*}}{d\beta} < 0$ .

In Corollary 2(1), the firm set her personalized service level only depending on the product price and cover the whole market. Based on the consumer  $i$ 's utility function, the additional profit of consumer's privacy information and the cost of personalized service are unrelative. Meanwhile, since the product price is given, the increasing unit value only increases the additional expected profit of the firm, and the increasing unit cost of personalized service only increases the cost of the firm.

But in the case that only part of the market is covered, an increasing unit value of consumer privacy information may reduce the firm's expected profit when the unit value of consumer privacy information is low and the unit cost of personalized service is high. The explanation is as follows, an increasing unit value of consumer privacy information increases the personalized service level and the potential demand, but it increases the cost simultaneously. As a result, the marginal expected profit decreases and is less than zero. Hence, the expected profit decreases in the unit value of consumer privacy information.

Corollary 2 suggests that if the firm can cover the whole market, she should try her best to fully explore the value of consumer privacy information. But if she only covers the market partly, she should be cautious to explore the value of consumer privacy information. Especially, when the unit cost of personalized service is high, but the unit value of consumer privacy information is relatively low, the firm should not try to explore the value of consumer privacy information.

#### 4.2. Firm's Personalized Service Efforts and Consumers' Purchasing Behaviour under Misrepresentation

In this section, we assume that consumers will misrepresent when they perceive the privacy risk when their personal information are collected by the monopolistic firm. Following the timing sequence in Section 3, with backward induction, we firstly derive the optimal proportion of privacy information. Consumers try to maximize their utilities as far as possible based on Equation 1, with F.O.C, we can derive the response function of optimal proportion of privacy information is:

$$k^F(e) = \frac{e^F}{2} \quad (4)$$

Equation 4 shows that when the monopolistic firm provides a greater personalized service level, consumers will disclose more privacy information. Intuitively, it is a win-win game, the firm provides a greater personalized service level which encourages consumers disclose more privacy information;

meanwhile, when consumers disclose more privacy information which will help the firm to provide a greater personalized service level.

Similar with the analysis in Section 4.1, consumer  $i$  buy the firm's product if  $u_i^F(\theta_i) \geq 0$ . Since the maximized potential demand is 1, we separate our analysis into two parts, one is the market is fully covered, the other is the market is partly covered. When the market is fully covered, consumer  $i$ 's minimized utility function is

$$ek - k^2 - p \geq 0 \quad (5)$$

When the market is partly covered, consumer  $i$ 's utility function is given as Equation (1), consumers whose utility satisfies  $u_i^F(\theta_i) \geq 0$  buy from the firm. Hence, we can derive the expected demand function as follows.

$$n_u^F(e^F) = \begin{cases} 1, & e^F \geq 2\sqrt{p} \\ \frac{(e^F)^2}{4} + 1 - p, & e^F < 2\sqrt{p} \end{cases} \quad (6)$$

In Equation (6), if the personalized service level is greater than  $2\sqrt{p}$ , all consumers in the market will buy from the firm, otherwise, only part of consumers buy from the firm and the expected demand increases in the firm's personalized service level. Combining Equation (2) and Equation (6), with F.O.C, we can derive the equilibrium solutions when consumers misrepresent as follows.

**Proposition 2.** If consumers misrepresent, the monopolistic firm's optimal personalized service level is  $e^{F*} =$

$$\begin{cases} \frac{\alpha}{4\beta}, & \beta \leq \frac{\alpha}{8\sqrt{p}} \\ 2\sqrt{p}, & \frac{\alpha}{8\sqrt{p}} < \beta < \frac{p}{4} + \frac{\alpha(1+2p)}{8\sqrt{p}} \\ \frac{4}{3\alpha} \left( 2\beta - \frac{p}{2} - \sqrt{\left(2\beta - \frac{p}{2}\right)^2 - \frac{3}{4}\alpha^2(1-p)} \right), & \beta \geq \frac{p}{4} + \frac{\alpha(1+2p)}{8\sqrt{p}} \end{cases}, \text{ correspondingly, the expected demand and}$$

expected profit of the monopolistic firm are

$$(n^{F*}, \pi^{F*}) = \begin{cases} \left(1, p + \frac{\alpha^2}{16\beta}\right), & \beta \leq \frac{\alpha}{8\sqrt{p}} \\ \left(1, (1 - 4\beta)p + \alpha\sqrt{p}\right), & \frac{\alpha}{8\sqrt{p}} < \beta < \frac{p}{4} + \frac{\alpha(1+2p)}{8\sqrt{p}} \\ (n_1^{F*}, \pi_1^{F*}), & \beta \geq \frac{p}{4} + \frac{\alpha(1+2p)}{8\sqrt{p}} \end{cases}, \text{ where } n_1^{F*} =$$

$$\frac{8 \left[ \left(2\beta - \frac{p}{2}\right) \left(2\beta - \frac{p}{2} - \sqrt{\left(2\beta - \frac{p}{2}\right)^2 - \frac{3}{4}\alpha^2(1-p)}\right) \right]}{9\alpha^2} + \frac{2}{3}(1-p), \quad \pi_1^{F*} =$$

$$\frac{16 \left[ \left(2\beta - \frac{p}{2}\right)^2 - \frac{3}{4}\alpha^2(1-p) \right] \left(2\beta - \frac{p}{2} - \sqrt{\left(2\beta - \frac{p}{2}\right)^2 - \frac{3}{4}\alpha^2(1-p)}\right) + 12\alpha^2(1-p)(\beta + 2p)}{27\alpha^2}.$$

Proposition 2 shows the monopolistic firm's optimal personalized service level, expected demand and profit when consumers misrepresent. Following the timing sequence in Section 3, consumers make their misrepresentation decisions depending on the firm's service level. Intuitively, the firm should increase their personalized service level to encourage consumers to provide more privacy information until she captures all consumers in the market. But providing personalized service is costly, a higher personalized service level increases the cost and may decrease the expected profit, so the firm may choose a different personalized service strategy to maximize her expected profit when the unit cost of personalized service is high.

Proposition 2 also shows that even the firm captures all consumers in the market, she is still driven to choose a higher personalized service level when the unit cost of personalized service is less than  $\frac{\alpha}{8\sqrt{p}}$ . The reason is a low unit cost of personalized service decreases the marginal cost and increases the firm's marginal expected profit. Hence, even the firm captures all the consumers in the market, she should increase her personalized service level when the unit cost of personalized service is low.

**Corollary 3.** If consumers misrepresent,

(1) When the market is fully covered, (i) when  $\beta \leq \frac{\alpha}{8\sqrt{p}}$ ,  $\frac{de^{F*}}{dp} = 0$ ; otherwise,  $\frac{de^{F*}}{dp} > 0$ . (ii) when  $\frac{\alpha}{8\sqrt{p}} < \beta < \frac{p}{4} + \frac{\alpha(1+2p)}{8\sqrt{p}}$ , if  $\alpha < \frac{1-p}{\sqrt{p}}$  &  $p > \frac{\alpha^2}{4(4\beta-1)^2}$ ,  $\frac{d\pi^{F*}}{dp} < 0$ , otherwise,  $\frac{d\pi^{F*}}{dp} > 0$ .

(2) When the market is partly covered, (i) when  $\beta < \frac{4+3a^2}{16}$ ,  $\frac{de^{F^*}}{dp} > 0$ ; otherwise,  $\frac{de^{F^*}}{dp} < 0$ .

Corollary 3 shows the relationship between the firm's optimal strategies and her price. In Corollary 3(a), the market is fully covered. When the unit cost of personalized service is low, if the monopolistic firm increases her price, she wouldn't increase her personalized service level simultaneously. Because when the unit cost of personalized service is low, the monopolistic firm captures all consumers in the market when she offers a service level equals to  $\frac{\alpha}{4\beta'}$  even she increases the price, consumers don't misrepresent more, so she won't increase her service level. But when the unit cost of personalized service is high, she should increase the price to maintain the marginal profit. But the relationship between the firm's profit and price is different. Corollary 3(a) indicates when the firm increases her price, even she increases her service level which increases her cost, she may get more profit. In Corollary 3(a), in the scenario where the unit value of consumer privacy information is low and the price is high, an increasing price may reduce the firm's profit, because in this scenario, the firm should provide a greater service level to attract consumers, but consumers will misrepresent more which reduce the firm's additional profit. Hence, in practice, the firm should avoid to increase her price in this scenario, or she should explore the value of consumer information.

In Corollary 3(b), the market is partly covered, when the unit cost of personalized service is high. When the unit cost of personalized service is low, the monopolistic firm increases her service level with an increasing price. The reason is, a greater price may increase the marginal profit of the firm, to capture more consumers, the firm will increase her personalized service level. But the relationship between the expected demand/profit and the price are complicated and non-linear. Because consumers misrepresent depending on the personalized service level which will impact on the additional profit and the service cost. To provide reasonable and smooth analysis of this paper, we didn't show the details.

Based on Proposition 2, we derive the following corollary.

**Corollary 4.** If consumers misrepresent,

(1) When the market is fully covered, (i) if  $\beta \leq \frac{\alpha}{8\sqrt{p'}}$ ,  $\frac{de^{F^*}}{d\alpha} > 0$ , otherwise,  $\frac{de^{F^*}}{d\alpha} = 0$ ;  $\frac{d\pi^{F^*}}{d\alpha} > 0$ . (ii) if  $\beta \leq \frac{\alpha}{8\sqrt{p'}}$ ,  $\frac{de^{F^*}}{d\beta} < 0$ , otherwise,  $\frac{de^{F^*}}{d\beta} = 0$ ;  $\frac{d\pi^{F^*}}{d\beta} < 0$ .

(2) When the market is partly covered, (i)  $\frac{de^{F^*}}{d\alpha} > 0$ ;  $\frac{d\pi^{F^*}}{d\alpha} > 0$ ,  $\frac{d\pi^{F^*}}{d\alpha} < 0$ . (ii)  $\frac{de^{F^*}}{d\beta} < 0$ ;  $\frac{d\pi^{F^*}}{d\beta} < 0$ ,  $\frac{d\pi^{F^*}}{d\beta} > 0$ .

Corollary 4 shows how the unit value of consumer's privacy information and unit cost of personalized service impacts on the monopolistic firm's optimal decisions when consumers misrepresent.

When the market is fully covered, meanwhile the unit cost of personalized service is low, a greater unit value of consumer's privacy information leads to a higher personalized service level, because the marginal profit increases. Similarly, a greater unit cost of personalized service leads to a lower personalized service level, because the marginal profit decreases. But when the unit cost of personalized service is medium, the monopolistic firm doesn't change her personalized service level when the unit value of consumer's privacy information or the unit cost of personalized service increases, because in this case, the marginal profit is only relative with the price, and cost of personalized service equals to the additional profit. Then, Corollary 4(a) shows that a greater unit value of consumer's privacy information leads to a higher expected profit, because the marginal profit increases, and a greater unit cost of personalized service leads to a lower expected profit, because the cost of personalized service increases and is greater than the additional profit.

Hence, when consumers misrepresent and the market is fully covered, the monopolistic firm should try to explore the value of consumer's privacy information and reduce her unit cost of personalized service.

When the market is partly covered, a greater unit value of consumer's privacy information leads to a higher personalized service level and captures more consumers, but get less profit. In this

scenario, a greater unit value of consumer's privacy information indicates a higher marginal profit, the firm increases her personalized service level to attract more consumers. But when the personalized service level increases, consumers will misrepresent more which may reduce the marginal profit, meanwhile, the cost of personalized service increases, hence, the expected profit decreases when the unit value of consumer's privacy information increases. Then, a greater unit cost of personalized service leads to less personalized service level, less consumers but more profits. In this scenario, a greater unit cost of personalized service indicates that the firm costs more to provide a unit personalized service level. To maximize her profit, the monopolistic firm should decrease her personalized service level to reduce the personalized service cost, which results to a less consumer demand. But the marginal profit increases because the decrement of unit personalized service cost is greater than the decrement of the unit additional profit, hence, the monopolistic firm can get more profit with a higher unit cost of personalized service.

Hence, when consumers misrepresent and the market is partly covered, the monopolistic firm should be more cautious to explore the value of consumer's privacy information and reduce her unit cost of personalized service.

#### 4.3. Comparison Analysis

Consumers may misrepresent and impact on the monopolistic firm's optimal strategies. In this section, we will compare the optimal strategies when consumers do not misrepresent with those when consumers misrepresent.

Based on Proposition 1 and Proposition 2, we firstly compare the optimal personalized service level, and analyze the effect of misrepresentation of firm's personalized service level. We can get the following results:

**Proposition 3.** Based on the optimal personalized service levels in Proposition 1 and Proposition 2,

- (1) if  $\alpha < \frac{2p\sqrt{p}(1-p)}{(1+p)(2p+1)-4\sqrt{p}}$
- i) When  $\beta < \frac{\alpha}{4(p+1)}$ ,  $e^F > e^B$ ;
- ii) When  $\frac{\alpha}{4(p+1)} < \beta \leq \frac{p+\alpha}{2(1+p)}$ ,  $e^F < e^B$ ;
- iii) When  $\frac{p+\alpha}{2(p+1)} < \beta < \frac{p(p+\alpha)+(p+\alpha)\sqrt{p^2+3(\alpha p+2p+\alpha)\alpha}}{4(\alpha p+2p+\alpha)}$  : a) If  $p > \frac{1}{3}$  and  $\frac{4p(1-p)}{(p+1)(3p-1)} < \alpha < \frac{2p\sqrt{p}(1-p)}{(1+p)(2p+1)-4\sqrt{p}}$ ,  $e^F > e^B$ ; b) If  $p \leq \frac{1}{3}$  or  $\alpha < \frac{4p(1-p)}{(p+1)(3p-1)}$ ,  $e^F < e^B$ .
- iv) When  $\beta > \frac{p(p+\alpha)+(p+\alpha)\sqrt{p^2+3(\alpha p+2p+\alpha)\alpha}}{4(\alpha p+2p+\alpha)}$ ,  $e^F < e^B$ .
- (2) if  $\alpha > \frac{2p\sqrt{p}(1-p)}{(1+p)(2p+1)-4\sqrt{p}}$
- i) When  $\beta < \frac{\alpha}{4(p+1)}$ ,  $e^F > e^B$ ;
- ii) When  $\frac{\alpha}{4(p+1)} < \beta < \frac{p+\alpha}{4\sqrt{p}}$ ,  $e^F < e^B$ ;
- iii) When  $\frac{p+\alpha}{4\sqrt{p}} < \beta < \frac{p}{4} + \frac{\alpha(2p+1)}{8\sqrt{p}}$ , a) If  $p \leq \frac{1}{2}$  or  $\alpha < \frac{2p(1-\sqrt{p})}{2p-1}$ ,  $e^B > e^F$ ; b) If  $p > \frac{1}{2}$  and  $\alpha > \frac{2p(1-\sqrt{p})}{2p-1}$ ,  $e^F > e^B$ .
- iv) When  $\frac{p}{4} + \frac{\alpha(2p+1)}{8\sqrt{p}} \leq \beta \leq \frac{p+\sqrt{p^2+12\alpha^2(p+\alpha)}}{8}$ , a) if  $\alpha > \frac{[(2p+1)^2-12p^2]+\sqrt{\Delta}}{24}$ ,  $e^F < e^B$ ; b) if  $\alpha < \frac{[(2p+1)^2-12p^2]+\sqrt{\Delta}}{24}$ ,  $e^F > e^B$ ; where  $\Delta = (12p^2 - (2p+1)^2)^2 + 96(2p+1)p^2\sqrt{p}$ .
- v) When  $\frac{p+\sqrt{p^2+12\alpha^2(p+\alpha)}}{8} < \beta < \frac{p(p+\alpha)+(p+\alpha)\sqrt{p^2+3(\alpha p+2p+\alpha)\alpha}}{4(\alpha p+2p+\alpha)}$ ,  $e^F > e^B$ ;
- vi) When  $\beta > \frac{p(p+\alpha)+(p+\alpha)\sqrt{p^2+3(\alpha p+2p+\alpha)\alpha}}{4(\alpha p+2p+\alpha)}$ ,  $e^F < e^B$ .

Based on the comparison results of  $e^F$  and  $e^B$ , we can have when the unit cost of personalized service is low, the monopolistic firm provides higher personalized service level if consumers misrepresent. When the unit cost of personalized service is high, the monopolistic firm provides lower personalized service level if consumers misrepresent.

But when the unit cost of personalized service is medium, the comparison results vary with the unit value of consumer's privacy information, the unit cost of personalized service and the product

price. When the unit value of consumer's privacy information is low, meanwhile the product price is high, the monopolistic firm provides higher personalized service level if consumers misrepresent. Otherwise, the monopolistic firm provides lower personalized service level if consumers misrepresent. When the unit value of consumer's privacy information is high, meanwhile, the price is high, the monopolistic firm provides higher personalized service level if consumers misrepresent. But when the unit cost of personalized service is relatively high, the monopolistic firm also provides higher personalized service level if consumers misrepresent.

Hence, if consumers misrepresent, the monopolistic firm should be cautious to increase her personalized service level to attract more consumers. Only when the unit cost personalized service level is low, her optimal choice is increasing her personalized service level. But if the unit cost personalized service level is high, her optimal choice is decreasing her personalized service level.

Furthermore, based on Proposition 1 and Proposition 2, we compare the expected demand if the market is partly covered, and derive the following results.

**Proposition 4.** When the market is partly covered, if  $\alpha < \frac{2p\sqrt{p}(2+p)}{(2p+1)(4-p)-12\sqrt{p}}$ ,  $n^F < n^B$ ; otherwise,  $n^F > n^B$ .

In Proposition 4, the market is partly covered, when the unit value of consumer's privacy information is low, the monopolistic firm gets less demand if consumers misrepresent. The reason is a low unit value of consumer's privacy information means a low additional profit which may make the monopolistic firm reduce her personalized service level. Then a reducing personalized service level can't attract more consumers which leads to a less consumer demand.

Proposition 4 indicates that consumer misrepresentation impacts on the demand of the monopolistic firm, and it varies with the unit value of consumer's privacy information. When the unit value of consumer's privacy information is low, consumer misrepresentation reduces the demand, otherwise, it enhances the demand.

Then, we compare the profit when consumers misrepresent and that when consumers don't misrepresent. We have:

**Proposition 5.** (1) When the market is fully covered, if  $0 < p < 1$  &&  $\frac{2\alpha - \alpha\sqrt{3-2\alpha p - 2}}{4(1+p)^2} \leq \beta \leq \frac{\alpha}{8\sqrt{p}}$ , or  $0.1951 < p < 1$  &&  $\frac{\alpha}{8\sqrt{p}} \leq \beta \leq \frac{\alpha(1-\sqrt{p})}{(1-p)^2}$ ,  $\pi^B > \pi^F$ ; otherwise,  $\pi^B < \pi^F$ .

(2) When the market is partly covered, there exists a threshold  $\frac{p}{4} + \frac{\alpha(1+2p)}{8\sqrt{p}} \leq \beta \leq F(\alpha, p)$ ,  $\pi^B > \pi^F$ ; otherwise,  $\pi^B < \pi^F$ .

Proposition 5 shows that even consumers misrepresent, the monopolistic firm still can be better off. Hence, in practice, the firm should not be severe about consumer misrepresentation.

## 5. Conclusions

### 5.1. Main Findings and Implications

Consumer personal data can benefit firms. Acknowledging this fact, firms take measures to encourage consumers to disclose privacy information. However, privacy information disclosure is a double-edged sword for consumers. To reduce privacy risk and get the benefit, some consumers choose to misrepresent with falsification information. The existing literatures focused on the effect of organizations' privacy protection on both consumers' privacy behaviour and firm's strategy, but little literatures studied the effect of consumers misrepresentation which is a typical measure of consumers' self-privacy protection on both firms and consumers. With a game-theoretic model, this paper analyzed the influence of consumers misrepresentation in a monopoly market. In our model, consumers decide their quantity of falsification information and privacy information and the firm decides its service level.

The results show that consumers misrepresentation may not decrease the firm's payoff. Hence the firm should not be opposed to misrepresentation. Because the unit cost of personalized service and the marginal cost of misrepresentation play moderating effect of misrepresentation on

consumers and the firm. In addition, the results also indicate that under misrepresentation, a consumer does not disclose less privacy information and the number of disclosing consumers may decrease. Meanwhile, under misrepresentation, the firm may still provide higher personalized service level than when consumers don't misrepresent. Furthermore, the unit cost of personalized service, the unit value of consumer's privacy information and the product price impact on the firm's optimal decisions different. If consumers misrepresent, when the market is partly covered, a greater unit value of consumer's privacy information will reduce the firm's profit, and a greater unit cost of personalized service increases the firm's profit.

The implication of the paper contains two parts. Firstly, if consumers' privacy concerns are high, the firm has to prevent these consumers from misrepresenting. That is because misrepresentation discourages consumers with high privacy concerns to disclose and the firm profits less from these consumers under misrepresentation. Otherwise, if consumers' privacy concerns are low, the firm does not have to take measures to stop misrepresentation. Under this scenario, the firm has to adjust its service strategy according to the value of consumers' privacy information and the marginal cost of misrepresentation. For example, if the value of consumers' privacy information is neither too high nor too low and the marginal cost of misrepresentation is high, the firm can provide low service level to consumers. Secondly, the existing literatures concluded misrepresentation to be a good way to decrease consumers' privacy risks and encourage consumers to disclose, while the paper gave a different conclusion. Misrepresentation is not always efficient for consumers to decrease privacy risks. Both benefits (the personalized service level) and costs (privacy risk and the opportunity cost of misrepresentation) take great effects on consumers.

### 5.2. Limitations and Future Work

We study the effects of misrepresentation on a monopolistic firm and consumers by comparing the scenario when consumers misrepresent and when all consumers don't misrepresent. Meanwhile, we suppose that consumers have the same value of privacy concerns. For future research, it is valuable to consider that consumers are with different valuations of privacy concerns. Furthermore, it would be interesting to study the scenario where only part of consumers misrepresent.

**Author Contributions:** Conceptualization, M.Z., Y.C. and S.M.; methodology, M.Z. and Y.C.; formal analysis, M.Z., Y.C. and S.M.; investigation, M.Z. and Y.C.; writing—original draft preparation, M.Z. and Y.C.; writing—review and editing, S.M. and W.Z.; supervision, S.M. and W.Z.; funding acquisition, S.M. and W.Z. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research was funded by National Natural Science Foundation of China (No. 72371069, No. 71371058), and National Key Research and Development Program of China (No. 2023YFC3804901).

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** Not applicable.

**Conflicts of Interest:** The authors declare no conflicts of interest.

### References

1. Barkatullah, A.H. Does self-regulation provide legal protection and security to e-commerce consumers? *Electronic Commerce Research and Applications* **2018**, *30*, 94-101.
2. Korzaan, M.L.; Boswell, K.T. The influence of personality traits and information privacy concerns on behavioral intentions. *Journal of Computer Information Systems* **2008**, *48*, 15-24.
3. Nofer, M.; Hinz, O.; Muntermann, J.; Roßnagel, H. The economic impact of privacy violations and security breaches: A laboratory experiment. *Business & Information Systems Engineering* **2014**, *6*, 339-348.
4. Van Slyke, C.; Shim, J.; Johnson, R.; Jiang, J.J. Concern for information privacy and online consumer purchasing. *Journal of the Association for Information Systems* **2006**, *7*, 1.
5. Milne, G.R.; Boza, M.-E. Trust and concern in consumers' perceptions of marketing information management practices. *Journal of interactive Marketing* **1999**, *13*, 5-24.

6. Son, J.-Y.; Kim, S.S. Internet users' information privacy-protective responses: A taxonomy and a nomological model. *MIS quarterly* **2008**, 503-529.
7. Poddar, A.; Mosteller, J.; Ellen, P.S. Consumers' rules of engagement in online information exchanges. *Journal of Consumer Affairs* **2009**, 43, 419-448.
8. Beresford, A.R.; Kübler, D.; Preibusch, S. Unwillingness to pay for privacy: A field experiment. *Economics letters* **2012**, 117, 25-27.
9. De Corniere, A. Search advertising. *American Economic Journal: Microeconomics* **2016**, 8, 156-188.
10. Esteves, R.-B.; Resende, J. Competitive targeted advertising with price discrimination. *Marketing Science* **2016**, 35, 576-587.
11. Hoffman, D.L.; Novak, T.P.; Peralta, M.A. Information privacy in the marketspace: Implications for the commercial uses of anonymity on the Web. *The Information Society* **1999**, 15, 129-139.
12. Iyer, G.; Soberman, D.; Villas-Boas, J.M. The targeting of advertising. *Marketing Science* **2005**, 24, 461-476.
13. Alkire, L.; Pohlmann, J.; Barnett, W. Triggers and motivators of privacy protection behavior on Facebook. *Journal of Services Marketing* **2019**, 33, 57-72.
14. Milberg, S.J.; Smith, H.J.; Burke, S.J. Information privacy: Corporate management and national regulation. *Organization science* **2000**, 11, 35-57.
15. Chen, K.; Rea Jr, A.I. Protecting personal information online: A survey of user privacy concerns and control techniques. *Journal of Computer Information Systems* **2004**, 44, 85-92.
16. Sannon, S.; Bazarova, N.N.; Cosley, D. Privacy lies: Understanding how, when, and why people lie to protect their privacy in multiple online contexts. In Proceedings of the Proceedings of the 2018 CHI conference on human factors in computing systems, 2018; pp. 1-13.
17. Adhikari, K.; Panda, R.K. Users' information privacy concerns and privacy protection behaviors in social networks. *Journal of Global Marketing* **2018**, 31, 96-110.
18. Guo, J.; Li, N.; Wu, Y.; Cui, T. Examining help requests on social networking sites: integrating privacy perception and privacy calculus perspectives. *Electronic Commerce Research and Applications* **2020**, 39, 100828.
19. Kruikemeier, S.; Boerman, S.C.; Bol, N. Breaching the contract? Using social contract theory to explain individuals' online behavior to safeguard privacy. *Media Psychology* **2020**, 23, 269-292.
20. Xie, W.; Karan, K. Consumers' privacy concern and privacy protection on social network sites in the era of big data: Empirical evidence from college students. *Journal of Interactive Advertising* **2019**, 19, 187-201.
21. Church, M.; Thambusamy, R.; Nemat, H. User misrepresentation in online social networks: how competition and altruism impact online disclosure behaviours. *Behaviour & Information Technology* **2020**, 39, 1320-1340.
22. Drouvelis, M.; Gerson, J.; Powdthavee, N.; Riyanto, Y.E. Large losses from little lies: Randomly assigned opportunity to misrepresent substantially lowers later cooperation and worsens income inequality. **2020**.
23. Hall, J.A.; Park, N.; Song, H.; Cody, M.J. Strategic misrepresentation in online dating: The effects of gender, self-monitoring, and personality traits. *Journal of Social and Personal Relationships* **2010**, 27, 117-135.
24. Kumar, A.; Gupta, S.K.; Rai, A.K.; Sinha, S. Social networking sites and their security issues. *International Journal of Scientific and Research Publications* **2013**, 3, 1-5.
25. Wirtz, J.; Lwin, M.O.; Williams, J.D. Causes and consequences of consumer online privacy concern. *International Journal of service industry management* **2007**, 18, 326-348.
26. Karl, K.A.; Peluchette, J.V. "Friending" professors, parents and bosses: A Facebook connection conundrum. *Journal of Education for Business* **2011**, 86, 214-222.
27. Ariffin, S.K.; Mohan, T.; Goh, Y.-N. Influence of consumers' perceived risk on consumers' online purchase intention. *Journal of Research in Interactive Marketing* **2018**, 12, 309-327.
28. Heng, X.; Hock-Hai, T.; Tan, B.; Agarwal, R. Effects of Individual Self-Protection, Industry Self-Regulation, and Government Regulation on Privacy Concerns: A Study of Location-Based Services. *Information Systems Research* **2012**, 23, 1342-1363.
29. Hui, K.-L.; Teo, H.H.; Lee, S.-Y.T. The value of privacy assurance: An exploratory field experiment. *MIS quarterly* **2007**, 19-33.
30. Mousavizadeh, M.; Kim, D.J.; Chen, R. Effects of assurance mechanisms and consumer concerns on online purchase decisions: An empirical study. *Decision Support Systems* **2016**, 92, 79-90.
31. Kaul, R. A Contemporary Analysis of Online Privacy & Data Protection in the context of Parallel Privacy Policies. *Scholedge International Journal of Management & Development* **2019**, 6.
32. Miller, A.R.; Tucker, C. Privacy protection and technology diffusion: The case of electronic medical records. *Management science* **2009**, 55, 1077-1093.
33. Goldfarb, A.; Tucker, C.E. Privacy regulation and online advertising. *Management science* **2011**, 57, 57-71.
34. Lee, D.-J.; Ahn, J.-H.; Bang, Y. Managing consumer privacy concerns in personalization: a strategic analysis of privacy protection. *Mis Quarterly* **2011**, 423-444.
35. Dinev, T.; Hart, P. An extended privacy calculus model for e-commerce transactions. *Information systems research* **2006**, 17, 61-80.

36. Karwatzki, S.; Dytynko, O.; Trenz, M.; Veit, D. Beyond the personalization–privacy paradox: Privacy valuation, transparency features, and service personalization. *Journal of Management Information Systems* **2017**, *34*, 369-400.
37. Rahmawati, Y. Analysis of E-Service Quality Dimensions towards Purchase Intention by Using Smartphone in Tokopedia. *International Journal of Management, Accounting & Economics* **2018**, *5*.
38. Wang, T.; Duong, T.D.; Chen, C.C. Intention to disclose personal information via mobile applications: A privacy calculus perspective. *International journal of information management* **2016**, *36*, 531-542.
39. Wu, W.-Y.; Quyen, P.T.P.; Rivas, A.A.A. How e-servicescapes affect customer online shopping intention: the moderating effects of gender and online purchasing experience. *Information Systems and e-Business Management* **2017**, *15*, 689-715.
40. Hann, I.-H.; Hui, K.-L.; Lee, S.-Y.T.; Png, I.P. Overcoming online information privacy concerns: An information-processing theory approach. *Journal of management information systems* **2007**, *24*, 13-42.
41. Chellappa, R.K.; Shivendu, S. Mechanism design for “free” but “no free disposal” services: The economics of personalization under privacy concerns. *Management science* **2010**, *56*, 1766-1780.
42. Sutanto, J.; Palme, E.; Tan, C.-H.; Phang, C.W. Addressing the personalization-privacy paradox: An empirical assessment from a field experiment on smartphone users. *MIS quarterly* **2013**, 1141-1164.
43. Zhu, H.; Ou, C.X.; van den Heuvel, W.-J.A.; Liu, H. Privacy calculus and its utility for personalization services in e-commerce: An analysis of consumer decision-making. *Information & Management* **2017**, *54*, 427-437.
44. Noor, U.; Awan, T.; Zahid, M. Examining the impact of personalization on online advertising engagement: Moderating role of privacy concerns of online users. *Business Review* **2019**, *14*, 31-46.
45. Chellappa, R.K.; Shivendu, S. An economic model of privacy: A property rights approach to regulatory choices for online personalization. *Journal of Management Information Systems* **2007**, *24*, 193-225.
46. Casadesus-Masanell, R.; Hervas-Drane, A. Competing with privacy. *Management Science* **2015**, *61*, 229-246.
47. Kang, Y.; Liu, Y.; Niu, B.; Wang, W. Weighted distributed differential privacy ERM: Convex and non-convex. *Computers & Security* **2021**, *106*, 102275.
48. Awad, N.F.; Krishnan, M.S. The personalization privacy paradox: an empirical evaluation of information transparency and the willingness to be profiled online for personalization. *MIS quarterly* **2006**, 13-28.

**Disclaimer/Publisher’s Note:** The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.