

The Impact of Comment History Disclosure on Online Comment Posting Behaviors

Abstract

Purpose: This study aimed to empirically examine the effectiveness of disclosing user comment history without disclosing personal identity as a nudge policy to refrain users from posting malicious content online.

Design/methodology/approach: We collected the number of comments and posters from the leading portal website in South Korea, Naver.com. To causally investigate the impacts of the new nudge policy on the number of comments and posters, we used the regression discontinuity design (RDD) approach.

Findings: We found that the new policy reduced all types of comments, including the number of malicious comments, self-deleted comments, and current comments. This resulted in an overall decrease in the total number of posted comments, which is considered a side effect. In addition, we found that the effect of the nudge policy, which disclosed user comment history has a stronger effect on older female users than their counterparts.

Originality: Our findings extend the current knowledge on a nudge policy being implemented by a website as a means to reduce malicious online content and how it impacts user content posting behaviors.

Keywords: Nudge policy, Malicious comments, User comment history, Online comments, Incivility

1. Introduction

We are observing a significant increase in user-generated content in online news (Weber 2014), partially due to website features that enable user participation in the form of commentary and debate (Domingo et al. 2008). By providing commentary and debating spaces, websites create an opportunity for active communication among users (Weber 2014). Readers can express their opinions and feelings in the comment sections of individual online news reports in online news media and portal websites' news services sections (Wu and Atkin 2017). Given the higher levels of anonymity in cyberspace, online comment sections allow for greater freedom and equality in expressing one's own opinions and feelings (Reader 2012).

However, sometimes the comments posted are deliberately malicious, which is a dilemma many newspaper websites continue to struggle with (Santana 2014). The negative effects of malicious comments have been evidenced in the existing literature. For example, Rösner et al. (2016) showed that exposure to uncivil comments increases readers' hostile cognitions. Literature suggests that anonymity is the main reason for malicious and offensive comments (Santana 2014). The anonymity in an online environment can foster aggressive behavior as it makes people less inhibited online than offline, which can be explained by the online disinhibition effect (Suler 2004). Recognizing the problems with the malicious comments, websites have tried to develop strategies to reduce incivility (Rowe 2015; Santana 2014).

As part of these mitigating strategies, many websites have gradually adopted identity disclosure policy (Pu et al. 2020). Removing anonymity to disclose actual user identity is a direct approach to reducing malicious comments; the effects of the policy have been studied in the extant literature (e.g., Pu et al., 2020). However, the negative effects of the direct approach that users are significantly discouraged from generating content for websites have been found (e.g.,

Pu et al. 2020). Hence, some websites have recently tried to adopt an indirect approach without disclosing user identity as a nudge strategy for the same purpose while minimizing the side effects of a direct policy. This is done by disclosing user comment history, not including any personal information, to nudge users to refrain from posting malicious content online. For example, Naver.com, the leading portal website in South Korea, implemented this new policy to disclose posters' previous comment history. Naver.com announced that the company adopts the new policy to reduce the number of malicious comments (Cho 2020)

Although the impact of the direct approach (disclosing one's user identity) on users has been studied (e.g., Pu et al., 2020), the impacts of an indirect approach (nudge policy) are still under-explored area. Thus, this study aims to examine how the new policy of disclosing a poster's comment history influences their own comment posting behavior, particularly changes in the number of comments posted. By analyzing data from Naver.com, one site that adopted the indirect approach of disclosing user comment history, we found that the new policy reduced all types of comments, including the number of non-compliant comments (e.g., malicious comments) and self-deleted, and current comments. This resulted in a decrease in the total number of comments being posted. As a result, the new policy is effective at reducing the number of malicious comments, but it also reduces the number of current comments (side effect), meaning that the ratio of malicious comments to total comments remains unchanged. Based on this, we have to state that the new policy, using a “nudge” approach, seems to be ineffective in terms of removing this side effect. Interestingly, we also found that the effect of the newly implemented policy has a stronger effect on older female users than counterparts. From the perspective of policymakers, Naver.com prioritizes developing a sophisticated policy over minimizing the side effect.

This study extends the current knowledge on a “nudge” policy implemented by a site to reduce malicious online content and how this impacts user content posting behaviors. The following sections review the extant literature and propose the hypotheses. Thereafter, we present an empirical analysis to test the proposed hypotheses. Finally, we discuss the findings, contributions, limitations, and future research directions.

2. Theoretical Background and Hypotheses Development

2.1. Nudge Strategy

A nudge refers to “any aspect of the choice architecture that alters people’s behavior in a predictable way without forbidding any options or significantly changing their economic incentives.” (Thaler and Sustein 2009, p. 6). The central premise behind the “nudge” is that people do not always behave in their own best interest, from an economic point of view (Kosters and Van der Heijden 2015). It is based on the Simon (1979)’s bounded rationality, which postulates that people cannot always make the optimal decisions because they lack the cognitive ability to process all the information needed for such decisions. That is, individuals’ decision-making processes are likely to be influenced by changes in the context from which they make choices. In this light, Thaler and Sunstein (2009) argue that making changes to the context as a nudge can steer people’s behavior towards desirable ends, and thus it can be applied to government policy as an effective substitute for coercive intervention. Based on this, a number of studies have looked into the effective application of the nudge approach in public policy, to encourage positive behavioral changes in people (Hansen and Jespersen 2013; Schmidt 2017; John et al. 2009; Jones et al. 2014; Ewert et al. 2021).

According to previous studies, nudges can be implemented by many actors, including governments, businesses, and even individuals. They can also come in a wide range of forms (Thaler and Sunstein 2009; Kosters and Van der Heijden 2015). In the context of our study, it is observed that some websites have adopted the nudge approach as a way of causing users to refrain from posting malicious content online. For example, beginning March 19th 2020, Naver.com, the leading portal website in South Korea, implemented this new policy to disclose posters' previous comment history. This policy makes it possible for Naver.com users to see all of a poster's Naver.com comments on news articles, their user IDs, and profile photo¹. Until March 2020, posters had the ability to choose whether or not to disclose their previous comments, but this new policy prevents users from opting out of making their comment history public — without exception. Naver.com adopted the new policy with the intention of reducing the number of malicious comments (those containing profanity), while minimizing the side effects that a direct policy could have.

As the nudge approach implemented in websites aims to reduce users' uncivil behaviors has not been studied, we examine the effects of the nudge approach by drawing on the cognitive evaluation theory. In the following sections, we review the literature on cognitive evaluation theory and then propose our main hypotheses based on the theory.

2.2. Cognitive Evaluation Theory

Cognitive evaluation theory explains how external events can facilitate or undermine an individual's intrinsic motivation (Deci and Ryan 1985; Ryan 1982; Reeve 2012; Chae et al.

¹ <https://www.mk.co.kr/news/it/view/2020/03/292443/>

2017). According to the theory, one of the most important fundamental needs to promote intrinsic motivation when satisfied is autonomy, and it refers to the perceived freedom to decide one's actions (Deci and Ryan 1987; Ryan and Deci 2000). Feeling autonomy means that individuals are free from being constrained by external pressures, enhancing intrinsic motivation for their actions (Raveendhran and Fast 2021). When individuals feel constrained in their actions in any way, it negatively influences their sense of autonomy and undermines intrinsic motivation for the actions (DeCharms 2013; Deci and Ryan 1987).

Cognitive evaluation theory suggests that the way in which people perceive external context is critical for determining their subjective sense of autonomy (Deci and Ryan 1985; Ryan 1982). The theory postulates that external context perceived by people has two functional aspects; a controlling aspect and an informational aspect (Deci and Ryan 1985). The controlling aspect of an external event is perceived by people as a constraint toward a specific way of behaving, whereas the informational aspect of an external event is perceived as a reward or feedback. For example, in the previous study on the context of schooling, Reeve (2012, p156) gave an example for the controlling aspect of an external event: "if you come to class on time, then I will give you special privilege." On the contrary, the example for the informational aspect given in the study is "Because your punctuality has improved so much, you have earned a special privilege." (Reeve 2012, p156).

Previous studies argue that the relative salience of the two different functional aspects of external events determines the impacts of the events on the subjective sense of autonomy from intrinsic motivation (Ryan 1982; Reeve 2012). That is, when people perceive external events as creating pressure to attain particular behavioral outcomes, they experience it as controlling, which hinders their subjective sense of autonomy (Ryan 1982). On the contrary, if the external

event is seen as informational and not controlling, it allows the subjective sense of autonomy to be enhanced (Ryan 1982). Based on this, we propose that the new policy of a website to disclose users' comment history is perceived as controlling external event rather than an informational external event, which will negatively influence a user's autonomy and intrinsic motivation for posting comments on the website. As the posting contents and comments are entirely voluntary acts of users (Pu et al., 2020), users' intrinsic motivation is significant for them to contribute by creating content and posting comments. Hence, by drawing on the cognitive evaluation theory and relevant literature, we develop our hypotheses in terms of how the policy of disclosing comment history of users influences comment posting behaviors in the following section.

2.3. The Impacts of Disclosing Comment History on Comment Posting Behavior.

Based on the cognitive evaluation theory, we expect that users would perceive the policy of disclosing users' comment history as a change made in an attempt to control their behaviors. Users who post malicious comments are likely to perceive the policy of disclosing comment history as the controlling external event because it would lessen the degree of possible anonymity. It has been suggested that anonymity is the main reason why users post uncivil and offensive online comments. Santana (2014) compared anonymous and non-anonymous comments and demonstrated that anonymous comments are significantly more uncivil than non-anonymous. It is because anonymity allows users to suspend their consciousness of consequences and thus adopt a sense of being less inhibited in their self-expression (Santana 2014). Rösner and Krämer (2016) also found that users tend to conform to an aggressive social norm and that the effect is stronger in an anonymous environment. As the policy of disclosing comment history is likely to be perceived as lessening the possibility of anonymity it is expected

that those who post malicious comments will regain concern for the possibility of being negatively judged by other users (Van Boven et al. 2005). The potential negative judgment by others will cause people who post malicious comments to feel pressured into behaving in a socially desirable manner (Raveendhran and Fast 2021), which is likely to result in fewer malicious online comments.

We also expect that disclosure of one's comment history will affect the normal users, not just those who post malicious comments. Posting comments online spaces is a form of information sharing behavior, and information sharing behaviors have been explained with concepts such as social exchange theory in existing literature (Kankanhalli et al. 2005; Lee et al. 2006; Liang et al. 2008; Osatuyi 2013; Wu et al. 2014; Kim et al. 2020). According to the theory, one of the main intrinsic motivations for sharing information is the enjoyment of helping others for altruistic reasons by sharing personal opinions (Wasko and Faraj 2005; Henning-Thurau et al. 2004). However, as the new policy is likely to be perceived as controlling external event geared toward enforcing a specific standard of behavior, it is likely to negatively influence the subjective sense of autonomy in freely posting personal opinions and feelings.

In addition, it is expected that the new policy heightens information privacy concerns for users posting online comments as users are not able to decide whether they would disclose their comment history or not. Information privacy refers to the right of individuals to make decisions with respect to their personal information, such as the amount of personal information to provide and when and how personal information is provided and used (Belanger et al. 2002; Van Zoonen 2016; Lee et al. 2019). According to the privacy calculus theory, people determine their behavioral responses based on whether the benefits obtained by providing personal information are a fair exchange for the threat to their privacy (Culnan and Bies, 2003; Smith et al., 2011).

Based on the theory, heightened information privacy concerns due to the new policy is likely to lead users to feel less benefits for posting online comments, which hinders their motivations of comment posting behaviors.

In conclusion, as discussed above, we expect that the newly introduced policy of disclosing user comment histories will negatively influence intentions to post online comments. Thus, we propose the following hypothesis.

H1: Disclosing the comment history of a poster will negatively influence the overall volume of comments.

2.4. Differential Impacts of Disclosing Comments History in terms of Age and Gender

We expect that the newly implemented policy for disclosing comment history has differential effects on users depending on their age and gender. They have been found to be important demographic information that predicts the responses to changes in external events, particularly in terms of information privacy concerns. It is because such demographic information is related to levels of conservatism. Conservatism is defined as a tendency to preserve or keep intact or unchanged, and the tendency can be extended to political, religious, business, and social issues (Cornelis et al., 2009). It has been suggested that one of the key components of conservatism is to defend the status quo (Jost et al., 2003). That is, people with a high level of conservatism are likely to respond to the external change more negatively, particularly if the change is perceived as controlling to constrain their behaviors.

Previous studies have examined the relationship between age and conservatism and found that they are positively correlated (Henningham 1996; Maltby 1997; Cornelis et al. 2009). That

is, older people have a stronger tendency to preserve the current situation unchanged. In this light, the newly implemented policy of disclosing users' comments history is likely perceived by older users as a more controlling external event than an informational external event. The policy of disclosing comment history is likely to be perceived as a way toward specific behaviors by decreasing the level of anonymity of users. This view is supported by prior studies showing that information privacy concerns increase with age (Rainie et al., 2013; Walrave et al. 2012; Youn 2009; Paine et al., 2007). In line with this, other studies also indicated that age is negatively associated with self-disclosure in an online environment (Hinduja and Patchin 2008; Peter and Valkenburg 2011; Taddicken 2014). Thus, it is expected that the new policy will have a stronger negative effect on older users than it does on younger users as older users have higher levels of information privacy concerns already and a higher tendency to preserve the current situation unchanged. This would result in more decrease in the number of comments posted by older users than younger users.

Furthermore, in addition to age, studies have indicated the relationship between gender and information privacy concerns (Omarzu 2000; Sheehan 1999; Graeff and Harmon 2002). They have taken the perspective that females are more concerned about personal information privacy. For example, Rowan and Dehlinger (2014) found that female users of mobile device have higher levels of privacy concerns than male users. Similarly, Litt and Hargittai (2004) showed that female users are more likely to control their privacy information in an online environment by changing personal information settings than male users. These findings align with evidence in the literature that women are generally more risk-averse than men (e.g., Eckel and Grossman 2004; Croson and Gneezy 2009; Hyun et al. 2021). Thus, based on the above arguments, we propose the following hypothesis.

H2: The negative effects of disclosing comment history of a poster will be stronger for aged female users than for aged male users.

3. Empirical Approach

3.1 Data Collection

We collected online comment data from the portal website, Naver.com. According to Ma et al. (2019), Naver.com is the leading portal website in South Korea (about 70% of the search market in South Korea²). The company publicly provides the daily-based number of comments and posters through “DataLab”³. The comments are user-generated responses to news stories (Economy, I.T., Life, Politics, Society, World, and Others) provided by the press. The collected data spans from January 2020 to May 2020. Table 1 shows the definitions of the main variables used in this study, the total number of comments and the number of posters. The total number of comments consists of three elements: the number of current comments, self-deleted comments, and non-compliant comments.

<Table 1 about here>

Table 2 provides the summary statistics of gender-based comments and poster numbers. Comment posters are comprised of males and females. The average total number of comments posted by males is about 280,000, while that posted by females is about 100,000. Males tend to express their opinions more openly. Meanwhile, the average number of male posters is about 100,000, and that of female posters is about 40,000. The average number of comments posted by

² <https://www.link-assistant.com/blog/google-vs-naver-why-cant-google-dominate-search-in-korea/>

³ The screenshot of “DataLab” is provided in the Appendix.

a male poster is about 2.855 ($281,468.2/98,582.7$). That by a female poster is about 2.474 ($98,731.1/39,906.8$). Males seem to have a greater willingness to express their opinions.

<Table 2 about here>

Table 3 shows the number of comments and posters over the age groups. In the case of male posting, the majority of the comments were posted by males in their forties and fifties, while females posted that in their thirties and forties. The same phenomena occur to the number of posters.

<Table 3 about here>

Table 4 provides model-free comparisons of the change in comment numbers and posters before and after the policy change. The average daily number of comments posted by male posters was about 280,000, and the average daily number of male posters was about 100,000 before the policy change. Meanwhile, the comments posted by male posters increased (287,823 from 280,167), and that of male posters also increased (106,461 from 96,970) after the policy change. These changes also apply to the number of female comments and that of female posters. These appearing phenomena show that the new policy would only positively affect comment generation. However, COVID-19 has permeated our everyday lives since 2020. Due to social-distancing protocols, which have further necessitated telecommuting, internet usage would have also increased in 2020. It could have made Naver.com users more responsive to the news stories. Due to this, the effects observed throughout 2020 need to be considered, which requires further investigation. In the following empirical section, we use the Regression Discontinuity Design (RDD) approach to address this issue.

<Table 4 about here>

3.2 Empirical Model and Results

To causally identify the impacts of the new comment policy on comment posting (the number of comments and posters), we implement the regression discontinuity design (RDD). This approach uses a jump in the number of comments (posters) in the preceding days and for the days following the date of the policy implementation on March 19th, 2020, the comment history system launch date. The sample period extends from January 1st, 2020, to May 31st, 2020.

We exploit the following RDD specification:

$$y_{tc} = \alpha + \rho * P_d + \gamma * d + \theta_m * I\{Month_m\} + \mu_d * I\{Day of the Week_d\} + \delta_c + \varepsilon_{tc} \quad (3)$$

where y_{tc} represents the dependent variables (the number of comments and posters), which are log-transformed. P_d is a treatment variable (binary variable), which is 1 if the post date of the comments falls on March 19th, 2020, or later. Otherwise, it is 0. d is a running variable (R.V.), a linear control variable (number of days before March 19, 2020, or after 19, 2020, in our setting), which shows the deviation from the date of the new policy. γ represents an over-time trend of comment posting around the time period of the new policy, while ρ shows discontinuity in comment posting after March 19th, 2020, which is what we are interested in. $I\{Month_m\}$ and $I\{Day of the Week_d\}$ are dummy variables to control month-specific and day of the week-specific fixed effects. Since there exists a fluctuation in comment generation over time, we control month and day of week fixed effects. δ_c controls age-group specific fixed effects. The age groups include tens, twenties, thirties, forties, fifties, sixties, and over sixties. Finally, we consider heteroscedasticity with robust standard errors (Lee and Lemieux, 2010). Based on the above model specification, we use fixed-effects models with robust standard errors.

Table 5 shows the empirical results of the regression discontinuity models regarding the number of posted comments. The results of the first three columns are based on the comment data posted by male posters, and those of the last three columns are based on the comment data posted by female posters. Our interests center on the estimated coefficients (ρ) for “Treatment (treatment variable)”. Because “Treatment” is determined solely by the running variable (R.V.), the estimation bias of the RDD approach can come from whether the effect of the running variable on comment posting can be captured by a linear function (RDD model specification mistakes). To reduce the likelihood of specification mistakes, we consider a diversity of model specifications, including nonlinearities. The first column (1) only allows the same linear trend before and after the new policy. The second column (2) allows different linear trends on either side of the policy change. Meanwhile, the third column (3) specifies the quadratic trend in the model by incorporating polynomial terms of the running variable (R.V.). From these three models, we find that the estimated coefficient of “Treatment” is significantly negative, meaning that the new policy has had negative impact on the total number of comments posted by male posters ($\beta_{\text{Treatment}}=-.30$, $p\text{-value}<.01$, $\beta_{\text{Treatment}}=-.34$, $p\text{-value}<.01$, and $\beta_{\text{Treatment}}=-.30$, $p\text{-value}<.01$, respectively).

The last three columns ((4), (5), and (6)) have the same model specifications as those of the first three ((1), (2), and (3)), respectively. The results are based on the comment data posted by female posters. From these three models, we also find that the estimated coefficients of “Treatment” are significantly negative ($\beta_{\text{Treatment}}=-.32$, $p\text{-value}<.01$, $\beta_{\text{Treatment}}=-.37$, $p\text{-value}<.01$, and $\beta_{\text{Treatment}}=-.31$, $p\text{-value}<.01$, respectively). These models show that the policy negatively influences the overall volume of comments, supporting H1.

Based on the empirical results of the second column (2), we find an increasing trend in the number of comments before the launch of the policy, but after the launch, there was a decreasing

trend in the number. This also happens to female comments based on the result of the fifth column (5). On the other hand, the squared terms in the third and sixth columns (3) and (6) are not statistically significant. Though the squared terms are not statistically significant, we think including the squared terms could reduce the mistake with model specifications in RDD. Therefore, we use the third and sixth model specifications as the baseline to test H2 and robustness check.

<Table 5 about here>

Table 6 shows the empirical results of the regression discontinuity models regarding the number of comment posters. In these model specifications, we try to confirm that the new comment policy has a negative impact on the number of posters as well. Similar to Table 5, the first three columns show the results of the male posters, and the other three columns provide those of the female posters. Our interests are also the estimated coefficients for “Treatment (treatment variable)”. From the three models ((1), (2), and (3)), we acknowledge that the estimated coefficients of “Treatment” are significantly negative, meaning that the new policy has decreased the number of male posters ($\beta_{\text{Treatment}}=-.19$, $p\text{-value}<.01$, $\beta_{\text{Treatment}}=-.22$, $p\text{-value}<.01$, and $\beta_{\text{Treatment}}=-.21$, $p\text{-value}<.01$, respectively).

Columns (4), (5), and (6) show the same results based on the same model specifications as those of columns (1), (2), and (3), respectively. From the three models, we also find that the new policy also decreases the number of female posters because the estimated coefficients of “Treatment” turn out to be all significantly negative ($\beta_{\text{Treatment}}=-.20$, $p\text{-value}<.01$, $\beta_{\text{Treatment}}=-.24$, $p\text{-value}<.01$, and $\beta_{\text{Treatment}}=-.25$, $p\text{-value}<.01$, respectively). These results also support H1 in terms of the negative impacts of disclosing comment history on the number of comment posters.

On the other hand, we can see that the negative impacts of “Treatment” on comments posted by females and on the number of female posters are greater than those posted by males and on the number of male posters in Tables 5 and 6. This is related to H2. In the next section, we test whether the negative impacts of the new policy are stronger for aged female posters than for aged male posters.

<Table 6 about here>

To confirm the second hypothesis (H2), we compare the impacts of disclosing comment history on the number of aged male and female posters. Following prior literature (Lee et al., 2019), we define the aged population as comment posters in the fifties and over fifty. Tables 7 and 8 show the empirical results. Table 7 shows the empirical results of the aged male posters, and Table 8 provides those of the aged female posters. The model specifications are basically the same as those in Tables 5 and 6. We only consider a linear trend in the first column (1). In the second column (2), we allow different linear trends around the new policy date. On the other hand, in the third column (3), we also consider the existence of nonlinearity by incorporating the squared terms. These model specifications apply to other columns.

From the first three columns, we find that the new policy decreases the number of male posters in the fifties ($\beta_{\text{Treatment}}=-.19$, $p\text{-value}<.01$, $\beta_{\text{Treatment}}=-.21$, $p\text{-value}<.01$, and $\beta_{\text{Treatment}}=-.21$, $p\text{-value}<.01$, respectively). And we also find that it also decreases that of female posters in the fifties ($\beta_{\text{Treatment}}=-.27$, $p\text{-value}<.01$, $\beta_{\text{Treatment}}=-.29$, $p\text{-value}<.01$, and $\beta_{\text{Treatment}}=-.29$, $p\text{-value}<.01$, respectively). All the estimated coefficients of “Treatment” for female posters are greater than those for male posters in fifties, supporting H2. The negative impacts of the new policy are greater to old female posters than on old male posters. The same phenomena occur in other old age groups.

The estimated coefficients of columns (4), (5), and (6) for the age-group “sixties” in Table 7 are all significantly negative ($\beta_{Treatment}=-.20$, $p-value<.01$, $\beta_{Treatment}=-.22$, $p-value<.01$, and $\beta_{Treatment}=-.18$, $p-value<.01$, respectively), but these are smaller than the estimated coefficient of columns (4), (5), and (6) in Table 8 ($\beta_{Treatment}=-.26$, $p-value<.01$, $\beta_{Treatment}=-.28$, $p-value<.01$, and $\beta_{Treatment}=-.25$, $p-value<.01$, respectively). The last three columns for the age-group “over sixties” in Table 7 and Table 8 show the same results ($\beta_{Treatment}=-.19$, $p-value<.01$, $\beta_{Treatment}=-.20$, $p-value<.01$, and $\beta_{Treatment}=-.16$, $p-value<.01$, respectively in Table 7, $\beta_{Treatment}=-.22$, $p-value<.01$, $\beta_{Treatment}=-.24$, $p-value<.01$, and $\beta_{Treatment}=-.24$, $p-value<.01$, respectively in Table 8). From these results, we can reach the conclusion that the negative impacts of disclosing comment history of a poster will be stronger for aged female posters than for aged male posters, supporting H2. In the robustness check section, we statistically test whether the degree of the negative impacts of the policy is greater for aged female posters than for aged male posters.

<Table 7 about here>

<Table 8 about here>

Figure 1 shows the graphical representation of the changes in the number of comments posted by old-group male and female posters based on the model specifications of Tables 7 and 8 ((3), (6), and (9)). In South Korea, COVID-19 became a critical social issue around the middle of January 2020. In January 2020, the number of comments, including total, self-deleted, non-compliant comments, started to increase gradually. However, right before the implementation of the new policy, all comment types sharply increased in number. Around February 26th, 2020, there was a serious discussion regarding a major cluster infection in Daegu, one of the main cities in South Korea. It might have ignited a lot of comments. The vertical red line shows the day of the enforcement of the new policy. As is confirmed from the figures, the number of

posted comments tends to drop around the day of the enforcement. This phenomenon is observed in all the figures.

<Figure 1 about here>

3.3 Robustness Check

The bandwidth (from January 1st to May 31st) could be too long to investigate the impacts of the new policy on comment generation. Due to this, in the first robustness check, we reduce the bandwidth (from February 1st to April 30th), including the day of the new policy though there remain fewer observations. By changing the bandwidth, we can say that the empirical results are robust regarding the selection of bandwidth. Table 9 shows the empirical results based on the sample with reduced bandwidth.

The estimated coefficients of “Treatment” are basically the same as those in Table 5. The new comment policy has negative impacts on the number of posted comments. The estimated coefficients of “Treatment” for male posters are all significantly negative ($\beta_{Treatment}=-.30$, $p-value<.01$, $\beta_{Treatment}=-.35$, $p-value<.01$, and $\beta_{Treatment}=-.21$, $p-value<.01$, respectively). And those for female posters are all significantly negative ($\beta_{Treatment}=-.31$, $p-value<.01$, $\beta_{Treatment}=-.37$, $p-value<.01$, and $\beta_{Treatment}=-.15$, $p-value<.01$, respectively). These results show that the new policy negatively impacts comment posting with a shortened sample period.

<Table 9 about here>

With respect to testing the second hypothesis (H2), there could be a concern that comparing the estimated coefficients based on tables (Table 7 and Table 8) would not be statistically sufficient. Because of this concern, we conduct the test on the equality of estimated coefficients based on

prior studies (Kim et al., 2020; Paternoster et al., 1998; Clogg et al, 1995). Table 10 provides the empirical results for the impacts of the new policy on the number of aged male and female posters (fifties and over fifty). The model specifications are the same as those in Table 6. The estimated coefficients of “Treatment” for aged male posters are all significantly negative ($\beta_{Treatment}=-.19$, $p-value<.01$, $\beta_{Treatment}=-.21$, $p-value<.01$, and $\beta_{Treatment}=-.18$, $p-value<.01$, respectively). This means that the new policy has a negative impact on the number of aged male posters. Those for aged female posters are also significantly negative ($\beta_{Treatment}=-.25$, $p-value<.01$, $\beta_{Treatment}=-.27$, $p-value<.01$, and $\beta_{Treatment}=-.26$, $p-value<.01$, respectively), showing that the new policy also has a negative impact on the number of aged female posters. And the degree of the impacts on aged female posters seems to be greater. To confirm whether the impacts of the new policy on the number of aged female posters are greater, we use the following equation:

$$Z = \frac{\hat{\beta}_{Treatment \text{ for aged male posters}} - \hat{\beta}_{Treatment \text{ for aged female posters}}}{[(S.E(\hat{\beta}_{Treatment \text{ for aged male posters}}))^2 - (S.E(\hat{\beta}_{Treatment \text{ for aged female posters}}))^2]}$$

where S.E. means the standard error of the estimated coefficients, β .

In this test, the null hypothesis is that the coefficients of the influences of the new policy on the number of aged male and female posters are equal. And based on the estimated coefficients and their standard errors in Table 10, we reject the null hypothesis (90% confidence level). This shows that the impacts of the new policy on the number of aged female posters are greater than those of aged male posters, statistically supporting the second hypothesis (H2)⁴.

<Table 10 about here>

⁴ We conduct the same equality test about whether the impacts of the new policy are the same for young male and female posters, where young means tens, twenties, and thirties. We use the same model specifications in Table 10. Interestingly, the findings show that the degree of the impacts on young male posters is greater though the differences in the impacts are not statistically significant (90% confidence level).

4. General Discussion

4.1. Summary

This study aimed to examine the effectiveness of a policy disclosing user comment history to refrain users from posting malicious content online. We analyzed data collected both the number of comments and posters from the leading portal website in South Korea, Naver.com. As a result of the analysis, we found that the new policy reduced all types of comments, including the number of malicious comments, self-deleted comments, and current comments. This resulted in an overall decrease in the total number of comments being posted. Additionally, we examined the moderating effects of key demographic characteristics and found that the effect of the policy, which disclosed user comment history has a stronger effect on older female users than their counterparts.

4.2. Implications

Some websites implemented the new policy of disclosing user comment history as an indirect approach to nudge users into not posting malicious comments. Given the higher levels of anonymity in cyberspace, sometimes comments posted are malicious and offensive (Santana 2014). Recognizing the potential effects malicious comments could have, websites have tried to develop strategies aimed at reducing incivility (Rowe 2015; Santana 2014). As a part of these strategies, identity disclosure policy has been gradually adopted by many websites, and the effect has been previously studied (e.g., Pu et al., 2020). The study examined a large online community that chose to disclose users' identities in one section but not the other. The results indicate strong displacement effect that users' efforts to generate content were reallocated to the section where

users remain anonymous (Pu et al. 2020). The success of user-generated content websites depends on users' voluntary contributions (Goes et al. 2016), and thus, identity disclosure is a double-edged sword, as per Pu et al., (2020) study. Hence, other websites have recently tried to adopt an indirect approach of disclosing user comment histories, but not their actual identity, with the same goal in mind –nudging users to avoid malicious content online. However, the effect of the policy of taking an indirect approach has not yet been studied.

Our findings show that the indirect approach, implemented with the intention of nudging users, effectively reduces the number of malicious comments. However, it has its drawbacks as the indirect approach also reduces the number of current comments, resulting in a decrease in the number of comments posted by users. The success of websites depending on user-generated content is heavily dependent on users' voluntary contributions to an ongoing conversation (Goes et al., 2016). Motivating users to voluntarily generate more content and making them exert greater effort when creating the content is important for the success of such websites (Pu et al., 2020). Considering this, our findings will be quite different from the ideal outcome of implementing the new policy for websites.

In this sense, the indirect approach of nudging users' behaviors might need to be revisited in order to find a way to improve it. Based on the cognitive evaluation theory, it could be suggested that websites should design a new policy that users can perceive as an informational external event rather than a controlling external event. The theory suggests that if the external event is seen as informational and not controlling, it provides the opportunity for the subjective sense of user autonomy to be enhanced (Ryan 1982). Then, the new policy will be less likely to discourage the users posting compliant comments to express their opinions, while the users posting malicious comments still feel pressured into behaving in a socially desirable manner by

potential negative judgment due to the lessened possibility of anonymity (Raveendhran and Fast 2021). This would increase the new policy's effectiveness in reducing malicious comments by minimizing the negative effects the new policy could have on ordinary users.

In addition, when it comes to designing a new policy to reduce malicious non-compliant comments, it is also suggested that websites need to consider providing more benefits for users posting compliant comments. It might be inevitable that users become concerned about information privacy even with a newly implemented indirect nudge policy. The privacy calculus theory explains behavioral changes among individuals who provide their personal information in relation to information privacy concerns. In other words, individuals determine their behavioral responses in terms of personal information provision by calculating a trade-off between the benefits of providing personal information and threats to their privacy (Culnan and Bies, 2003; Smith et al., 2011; Lee et al. 2019). Based on this, if a new policy is designed in a way to increase the benefits for users posting compliant comments, they would still be encouraged to contribute to the websites although they have heightened information privacy concerns due to the new policy. Furthermore, based on the privacy calculus theory, upon the implementation of the new policy, it could be also expected that users are likely to have different levels of information privacy concerns depending on which news or issues they make comments on. It is because users might feel more heightened information privacy to speak out about sensitive issues when they feel lessened anonymity in an online environment. For example, users may be more reluctant to actively express their opinions on more sensitive news such as political and social issues than more general issues when they perceive that their personal information is revealed due to the new policy. Thus, websites could also consider implementing a nudge policy by different topic categories to minimize the possible negative effects of the new policy.

Our research findings also showed that a decrease in the number of comments is more noticeable among older female users than older male users after the new policy of disclosing comment history had been implemented. We expected that the older users would be affected more negatively by the new policy because, based on previous studies, the older users tend to be more conservative in their discussion and have a stronger tendency to preserve the current situation (Jost et al. 2003). In addition, older females were found to have high information privacy concerns in the extant literature. Our analysis showed consistent results with the previous studies, and this finding has an important implication for websites whose target user segment is clearly aged female users. Additionally, and interestingly, we found that the gender effect is reversed for younger users. Although many studies indicate clear age and gender effects, there have also been some studies showing conflicting results in terms of the impacts of age and gender on information privacy concerns. For example, Zhang et al. (2013) and Jensen et al. (2005) did not find any significant differences in information privacy concerns by gender. Bergström (2015) found that information privacy concerns are higher among younger social media users. We believe that our additional findings on the reversed gender effects among younger users could provide a possible explanation for the conflicting results of previous studies in terms of age and gender effects on information privacy concerns. It would be worthwhile to further investigate with various sets of data in order to clarify the conflicting findings. Based on the current findings, it also has a managerial implication for practitioners in that different and additional communication strategies would be helpful for users of different ages and genders in reducing the negative effects of the new policy of disclosing the comment history of users.

Moreover, although it was not formally hypothesized, our additional findings on users' different levels of information privacy concerns in terms of different news topics can also

provide useful managerial insights for websites. We found that users were more sensitive to disclosing their comments history for political and social issues than other issues. Websites might need to consider this when they plan to adopt a new policy to disclose users' comments history. For instance, websites could consider first implementing the policy with sections of topics to which users are not sensitive and then gradually adopting the policy for other sections over time to minimize the possible negative effects.

4.3. Limitations and Future Research

Despite this study's contributions, limitations of this study should also be noted for possible future research directions. Our findings are based on the field data collected from one portal website, Naver.com., As user behaviors might be different depending on the website type, it would be worthwhile for future studies to investigate the data from other websites to generalize the findings. Also, it has been suggested that individual cultural backgrounds play an important role in people's behaviors, and thus it would be interesting to show how the policy of disclosing user comment histories differently influence users from different cultural backgrounds. The findings from different datasets will provide a deeper understanding and add richness to existing literature.

Furthermore, we only analyzed field data for this study. With field data, we are not able to show the underlying psychological mechanism of how users perceive the policy of disclosing comment history as a controlling external event as we proposed. Future studies might consider combining a field study and an experimental study to obtain more comprehensive findings on how the policy of disclosing comment history influences user behavior. Lastly, we confirmed

that the new policy more negatively influences aged and female users, resulting in fewer comments posted than counterparts. Interestingly, however, our additional analysis showed that the new policy's negative effects were reversed in younger users. Thus, future studies would be needed further to examine the interaction effects of age and gender to provide a more comprehensive understanding of the effects that the new policy could have on different types of users.

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Appendix



Table 1. Definitions of Main Variables

Variables	Description (a = age-group, t = day)
<i>The Total Number of Comments (TC)_{at}</i>	The number of total comments during a day (t) by an age-group (a). It includes the following types: current, self-deletion, and noncompliance.
<i>The Number of Comment Posters (CP)_{at}</i>	The number of comment posters during a day (t) by an age-group (a), which includes tens, twenties, thirties, forties, fifties, sixties, over sixties.

Table 2. The Daily Number of Comments and Posters based on Gender

	Male _t				Female _t			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
(TC) _t	281,468.2	86,444.5	141,965	676,375	98,731.1	52,480.7	38,592	384,601
(CP) _t	98,582.7	21,443.9	59,085	189,873	39,906.8	16,839.0	18,188	127,976

Table 3. The Daily Number of Comments and Posters Based on Age-group

	Male		Female	
	Mean of (TC) _t	Mean of (CP) _t	Mean of (TC) _t	Mean of (CP) _t
Tens	2,749.7	1,344.5	1,860.4	1,013.3
Twenties	23,572.4	10,209.2	9,349	4,676.5
Thirties	68,823.3	27,329.1	31,925.8	14,644.1
Forties	104,732.6	36,173.3	53,659.1	21,035.3
Fifties	87,237.4	26,396.3	30,946.3	10,361.2
Sixties	38,194.6	10,901.5	9,324.1	2,914.8
Over sixties	5,365.3	1,563.2	2,681.6	740.2

Table 4. Change in Comment Numbers and Posters Before and After the Policy Change

		Before March 19, 2020		After March 19, 2020 (Including March 19)		t-value (<i>p</i> -value)
		Mean	Std. Dev.	Mean	Std. Dev.	
Male	(TC) _t	280,167.6	4,190.1	287,823.8	5,847.0	0.79 (.09)
	(CP) _t	96,970.5	1,014.5	106,461.2	1,609.5	4.02 (.01)
Female	(TC) _t	95,765.2	2,530.9	113,224.8	3,423.9	3.01 (.00)
	(CP) _t	37,965.5	778.7	49,393.3	1,276.2	6.29 (.00)

Table 5. Empirical Results of Regression Discontinuity Design – The Number of Comments

	Sample Period (From Jan.1 st to May 31 st)			Sample Period (From Jan.1 st to May 31 st)		
	Male		Female			
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	-.30*** (.02)	-.34*** (.03)	-.30*** (.02)	-.32*** (.05)	-.37*** (.05)	-.31*** (.03)
R.V.	.01** (.01)	.02*** (.01)	.01*** (.01)	.01** (.01)	.02*** (.01)	.02*** (.01)
R.V. ²	No	No	-.01 (.01)	No	No	.01 (.01)
Treatment* R.V.	No	-.02*** (.01)	-.03*** (.01)	No	-.03*** (.01)	-.04*** (.01)
Treatment* R.V. ²	No	No	.01 (.01)	No	No	.01 (.01)
Monthly Dummy Day of Week	Included	Included	Included	Included	Included	Included
Dummy	Included	Included	Included	Included	Included	Included
Age-group Effect	Fixed	Included	Included	Included	Included	Included
Robust Errors	Standard	Included	Included	Included	Included	Included
Overall R ²	38.74%	44.34%	44.52%	43.19%	48.44%	48.75%
# of Obs.	1,064	1,064	1,064	1,064	1,064	1,064

where parentheses include the standard errors, *p<.10; **p < .05; ***p < .01. Obs. is observation.

Table 6. Empirical Results of Regression Discontinuity Design – The Number of Posters

	Sample Period (From Jan.1 st to May 31 st)			Sample Period (From Jan.1 st to May 31 st)		
	Male			Female		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	-.19*** (.01)	-.22*** (.01)	-.21*** (.01)	-.20*** (.05)	-.24*** (.04)	-.25*** (.04)
R.V.	.01** (.01)	.01*** (.01)	.01*** (.01)	.01*** (.01)	.02*** (.01)	.03*** (.01)
R.V. ²	No	No	.01 (.01)	No	No	.01 (.01)
Treatment* R.V.	No	-.02*** (.01)	-.02*** (.01)	No	-.02*** (.01)	-.04*** (.01)
Treatment* R.V. ²	No	No	.01 (.01)	No	No	.01 (.01)
Monthly Dummy Day of Week	Included	Included	Included Included	Included Included	Included Included	Included Included
Age-group Effect	Fixed	Included	Included	Included	Included	Included
Robust Errors	Standard	Included	Included	Included	Included	Included
Overall R ²		38.42%	43.79%	43.83%	44.42%	49.58%
# of Obs.		1,064	1,064	1,064	1,064	1,064
						49.87%

where parentheses include the standard errors, *p<.10; **p < .05; ***p < .01. Obs. is observation.

Table 7. Empirical Results of Regression Discontinuity Design – The Number of Aged Male Posters

	Sample Period (From Jan.1 st to May 31 st) Male (Fifties)			Sample Period (From Jan.1 st to May 31 st) Male (Sixties)			Sample Period (From Jan.1 st to May 31 st) Male (Over Sixties)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treatment	-.19*** (.01)	-.21*** (.04)	-.21*** (.07)	-.20*** (.03)	-.22*** (.04)	-.18*** (.06)	-.19*** (.03)	-.20*** (.03)	-.16*** (.06)
R.V.	.01 (.01)	.01*** (.01)	.01* (.01)	.01 (.01)	.01*** (.01)	.01 (.01)	.01* (.01)	.01*** (.01)	.01 (.01)
R.V. ²	No	No	.01 (.01)	No	No	-.01 (.01)	No	No	-.01 (.01)
Treatment* R.V.	No	-.01*** (.01)	-.02*** (.01)	No	-.01*** (.01)	-.01*** (.01)	No	-.01*** (.01)	-.01** (.01)
Treatment* R.V. ²	No	No	.01 (.01)	No	No	.01 (.01)	No	No	.01 (.01)
Monthly Dummy	Included	Included	Included	Included	Included	Included	Included	Included	Included
Day of Week Dummy	Included	Included	Included	Included	Included	Included	Included	Included	Included
Robust Standard Errors	Included	Included	Included	Included	Included	Included	Included	Included	Included
Overall R ²	64.89%	71.50%	72.01%	72.56%	75.85%	76.46%	76.37%	78.09%	78.60%
# of Obs.	152	152	152	152	152	152	152	152	152

where parentheses include the standard errors, *p < .10; **p < .05; ***p < .01. Obs. is observation.

Table 8. Empirical Results of Regression Discontinuity Design – The Number of Aged Female Posters

	Sample Period (From Jan.1 st to May 31 st) Female (Fifties)			Sample Period (From Jan.1 st to May 31 st) Female (Sixties)			Sample Period (From Jan.1 st to May 31 st) Female (Over Sixties)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treatment	-.27*** (.06)	-.29*** (.06)	-.29*** (.12)	-.26*** (.05)	-.28*** (.05)	-.25*** (.09)	-.22*** (.04)	-.24*** (.05)	-.24*** (.08)
R.V.	.01 (.01)	.01*** (.01)	.02* (.01)	.01 (.01)	.01*** (.01)	.01 (.01)	.01 (.01)	.01*** (.01)	.01 (.01)
R.V. ²	No	No	.01 (.01)	No	No	.01 (.01)	No	No	.01 (.01)
Treatment* R.V.	No	-.01*** (.01)	-.03*** (.01)	No	-.01*** (.01)	-.03*** (.01)	No	-.01*** (.01)	-.02*** (.01)
Treatment* R.V. ²	No	No	.01 (.01)	No	No	.01 (.01)	No	No	.01 (.01)
Monthly Dummy	Included	Included	Included	Included	Included	Included	Included	Included	Included
Day of Week Dummy	Included	Included	Included	Included	Included	Included	Included	Included	Included
Overall R ²	67.69%	72.23%	73.45%	68.31%	70.98%	73.02%	67.55%	73.34%	73.81%
# of Obs.	152	152	152	152	152	152	152	152	152

where parentheses include the standard errors, *p < .10; **p < .05; ***p < .01. Obs. is observation.

Table 9. Empirical Results of Regression Discontinuity Design – Robustness Check 1

	Sample Period (From Feb.1 st to Apr. 31 st)			Sample Period (From Feb.1 st to Apr. 31 st)		
	Male			Female		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	-.30*** (.02)	-.35*** (.02)	-.21*** (.03)	-.31*** (.03)	-.37*** (.03)	-.15** (.08)
R.V.	.01* (.01)	.02*** (.01)	-.03*** (.01)	.01* (.01)	.03*** (.01)	-.03*** (.01)
R.V. ²	No	No	-.01*** (.01)	No	No	-.01*** (.01)
Treatment* R.V.	No	-.03*** (.01)	.06*** (.01)	No	-.04*** (.01)	.05*** (.01)
Treatment* R.V. ²	No	No	-.01 (.01)	No	No	.01 (.01)
Monthly Dummy Day of Week	Included	Included	Included	Included	Included	Included
Age-group Fixed Effect	Included	Included	Included	Included	Included	Included
Robust Standard Errors	Included	Included	Included	Included	Included	Included
Overall R ²	28.48%	41.65%	53.24%	32.62%	44.68%	51.41%
# of Obs.	630	630	630	630	630	630

where parentheses include the standard errors, *p<.10; **p < .05; ***p < .01. Obs. is observation.

Table 10. Empirical Results of Regression Discontinuity Design – Robustness Check 2

	Sample Period (From Jan.1st to May 31st)			Sample Period (From Jan.1st to May 31st)		
	Old Male			Old Female		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	-.19*** (.02)	-.21*** (.02)	-.18*** (.03)	-.25*** (.03)	-.27*** (.03)	-.26*** (.04)
R.V.	.01*** (.01)	.01*** (.01)	.01** (.01)	.01*** (.01)	.01*** (.01)	.01*** (.01)
R.V. ²	No	No	.01 (.01)	No	No	.01 (.01)
Treatment* R.V.	No	-.01*** (.01)	-.01*** (.01)	No	-.01*** (.01)	-.03*** (.01)
Treatment* R.V. ²	No	No	.01* (.01)	No	No	.01 (.01)
Monthly Dummy Day of Week	Included	Included	Included	Included	Included	Included
Age-group Fixed Effect	Included	Included	Included	Included	Included	Included
Robust Standard Errors	Included	Included	Included	Included	Included	Included
Overall R ²	99.11%	99.22%	99.23%	97.82%	98.09%	98.16%
# of Obs.	456	456	456	456	456	456

where parentheses include the standard errors, *p<.10; **p < .05; ***p < .01. Obs. is observation.

Figure 1. Graphical Representation of the Changes in the Number of Comments

