

Exploring Consumer Hoarding Patterns: A Case Study Social Networks on Consumer Hoarding Behaviour of Toilet Paper

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Abstract: This article investigated the impact of social networks on consumer hoarding behavior during the COVID-19 pandemic, focusing specifically on the global toilet paper hoarding phenomenon. Motivated by the pandemic's widespread fear and uncertainty, the study filled a research gap by stressing the relevance of network science in understanding hoarding situations. The study, which examined a case study of the toilet paper scarcity that began in Hong Kong and extended globally, identified three major issues: the unique characteristics of online networks, the herding mentality promoted by social factors, and the asymmetry in information availability. To overcome these difficulties, the study suggests strategic options. It was suggested that artificial intelligence be used for content regulation and information validation in order to proactively counteract the unique features of internet networks. Targeted psychological interventions, notably stress reduction programs, were recommended to counteract the herding mindset that drives hoarding. To mitigate the impact of asymmetric information, media literacy initiatives aimed at improving consumers' critical thinking skills were suggested. Finally, this study gave important insights into the complex dynamics of social networks and consumer hoarding behavior during crises. It emphasized the importance of a comprehensive understanding of online networks' roles, laying the groundwork for future research in network science, consumer behavior, and crisis management.

Keywords: Online network, Herding, Asymmetric Information

1. Introduction

Since the emergence of the coronavirus in 2019, the world has experienced significant humanitarian and economic challenges. As of January 15, 2024, the global tally surpassed 699,620,241 infections, with more than 6,956,560 reported deaths [1]. The COVID-19 pandemic has not only caused widespread physical health issues but has also contributed to a surge in paranoid thinking and uncertainty among the general population. Several academic sources have discussed the development and validation of the Pandemic Paranoia Scale (PPS) to assess paranoid thinking specifically related to the pandemic. Experts have also highlighted the impact of the pandemic, stress, and misinformation on increasing anxiety and paranoid thoughts among individuals. This led consumers to engage in more first-order thinking when processing online information [2]. Consequently, the uncertainty

stemming from pandemic paranoia has influenced changes in consumption patterns. Alongside the global rise in the fear of infection, consumer behavior has undergone shifts that extend beyond typical geographic purchase patterns, affecting the timing, breadth, and volume of purchases. One noticeable global shift in behavior is the phenomenon of hoarding. Hoarding refers to the excessive accumulation and storage of goods or possessions beyond what is considered necessary or reasonable. This behavior can manifest in various forms, such as stockpiling food, household items, or other commodities. In our particular scenario, amid the COVID-19 pandemic, individuals engaged in extensive hoarding of toilet paper. The product rapidly depleted from supermarket shelves upon arrival, leading to a severe shortage in supply.

Anxiety, a fear of scarcity, and a need for control are some psychological factors that frequently motivate hoarding. Previous research has extensively examined the underlying reasons for hoarding behavior. Scholars, including Tolin, have conducted in-depth investigations into both psychological and biological factors that may contribute to hoarding. Tolin, in particular, conducted a quantitative analysis assessing the efficacy of ten different clinical treatments for hoarding behavior. His research explored how organic brain disease, depression, anxiety, and personality disorders may be linked to the development of hoarding tendencies [3]. In addition to clinical studies, quasi-experimental approaches have been employed to explore the impact of external factors on hoarding behavior. For instance, Leung conducted a mixed quantitative and qualitative research study during the COVID-19 pandemic, focusing on how information disseminated on Twitter could influence American consumers' purchasing habits. The study aimed to investigate whether panic spread more extensively online, leading to panic buying tendencies [4].

While much study has been undertaken on hoarding behavior, significant research gaps remain. Many studies concentrate on psychology-based theories, sometimes missing the importance of network science in understanding hoarding situations. Even when network science is referenced, previous research frequently lacks in-depth examinations of how the internet, with its unique clustering coefficients and informational diffusion paths, affects hoarding behavior. The COVID-19 epidemic has increased reliance on online platforms due to tight outbound restrictions, providing a unique opportunity to fill a study gap in understanding the impact of online networks on consumer behavior, particularly during emergencies. With unlimited resources and unexpected situations, today is an excellent time to investigate the function of online networks in shaping habits such as hoarding. This paper tries to fill this research gap by investigating how social networks influenced consumers' hoarding behavior, specifically toilet paper, during the COVID-19 pandemic, which had a global impact. The emphasis is on understanding the role of network science in modern society. This study is critical for understanding the media network's role in molding consumer behavior and discretionary spending patterns in a globally connected, technologically advanced world. Answering this question will allow future academics to use the findings to forecast new trends in many industries based on network activity. Furthermore, crisis management studies can build on this, with the statements released in this research serving as a consultation tool if the next crisis-induced hoarding occurs. Furthermore, business owners might use these findings to strategically influence consumer behavior, leading to increased economic success. Thus, this study has broader implications for understanding the dynamics of social networks, media influence, and consumer behavior in the current era.

A case analysis study will be done to address the research issue and investigate the worldwide hoarding behavior of toilet paper. This study looks at three important aspects of network science's impact in this situation: first, it looks at the unique features of online networks, such as clustering coefficients; second, it looks into how people tend to follow the crowd when using online networks, which could lead to hoarding of toilet paper; and third, it looks at how uneven information in digital networks affects people's decisions. The study concludes with suggested remedies to alleviate these inclinations, providing advice on how customers may make sensible purchasing choices amidst

difficult circumstances like the COVID-19 pandemic, avoiding mistakes influenced by online information. This study enhances our comprehension of the intricate relationship between network science and consumer behavior during times of crisis.

2. Case Study

The beginning of 2020 marked a turning point for public awareness of the severity of the COVID-19 pandemic. False rumors circulating on Twitter, suggesting that China would halt toilet paper exports, triggered widespread panic-buying and stockpiling. This phenomenon originated in Hong Kong in early February 2020 but swiftly spread globally. The toilet paper shortage became intertwined with COVID-19 news, creating a peculiar association between the two. The panic extended beyond Hong Kong, with various countries implementing measures to address the unprecedented demand for toilet paper. In Japan, efforts were made to secure toilet rolls in public toilets. In Singapore, popular newspapers responded by combating the rumors. In the UK, supermarkets had to resort to rationing toilet paper to prevent shortages. In the United States, supermarket shelves were emptied. Figure 1 illustrates the sales of tissue products in the United States from 2017 to 2020. It draws attention to a significant anomaly in 2020, which is characterized by a sharp increase in toilet paper sales. Although experts have confirmed that diarrhea is not a common symptom of COVID-19 and is rare among patients, consumers have displayed an increased sense of urgency to hoard toilet paper as a precautionary strategy [6].

Toilet tissue sales in the United States from 2017 to 2020

(in million U.S. dollars)

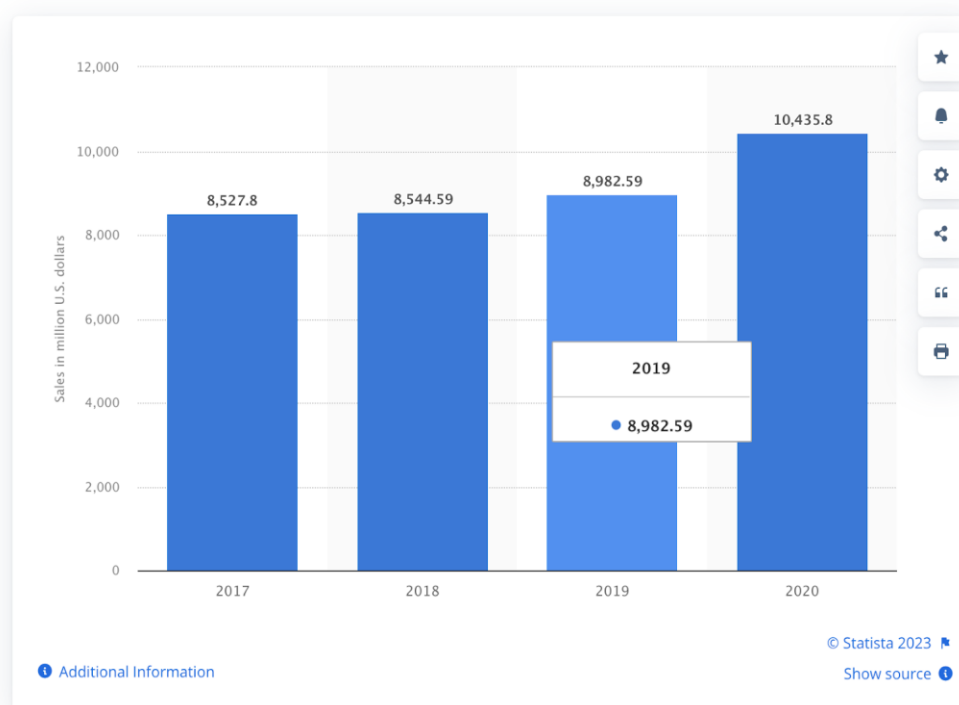


Figure 1: Toilet Tissue sales in the United States from 2017 to 2020 [5]

Therefore, a paramount issue has emerged: what underlies the phenomenon of consumers engaging in excessive hoarding, and, more precisely, in what ways has the online network played a role in facilitating this phenomenon? The resolution of this matter is imperative due to its potential ramifications; unveiling the underlying patterns is crucial for enlightening consumers.

3. Analysis on Problems

3.1. Reasons on the Unique Characteristics of Online Network

The absence of historical restrictions that previously prevented the transmission of information on the internet facilitates the quick dissemination of information. There have been big changes in the usual limits that come with the homophilic and clustered spread of ideas within social structures. These changes go against the usual ways that information is sent. Concurrently, stringent governmental restrictions on outdoor communication during the pandemic prompted a significant societal shift towards internet platforms for communication and information consumption. The heightened exposure of individuals to the concept of potential toilet paper scarcity amplifies the probability of engaging in hoarding behavior. Additionally, the rapid spread of information in digital networks generates information cascades, heightening the inclination to hoard as individuals follow perceived trends. Consequently, this collective response contributes to the global phenomenon of toilet paper stockpiling.

Kemp did a study in 2021 and discovered that over half a billion additional users joined social media networks between 2020 and 2021, representing a 13% increase [7]. Geographic data collection found that the locations with the highest growth in social media usage—Eastern Asia at 25.1% and Southeast Asia at 17.5%—also had the strongest COVID-related outing restrictions [7]. This is consistent with Leung's 2021 tweet study, which found that tweets with negative feelings were 3.5 times more likely to be retweeted and liked, indicating a larger distribution [4]. Furthermore, Alsayat and Hoda El-Sayed's 2016 study on social media networks found that knowledge spreads more widely and quickly on the internet [8]. Given the variety of online information sources, the resulting information cascades encourage consumers to place more trust in information, resulting in increased panic and illogical decision-making [8]. Unlike in real-life networks, where information is constrained to a small number of nodes characterized by homophily and clustering, these constraints no longer apply on the internet scale. With the enormous increase in social media usage, the significant clustering coefficient allows for the extensive transmission of information among a global audience. According to Alsayat and Hoda El-Sayed's idea, knowledge accumulation amplifies emotions, causing a widespread sense of terror among consumers worldwide, finally prompting them to hoard toilet paper.

3.2. Reasons on Herding Mentality

In the field of network research, the phenomenon of herding mentality is identified as a crucial predictor driving individuals to actively participate in toilet paper hoarding behavior, particularly when exposed to online information channels. In the context of network research, herding mentality refers to the phenomenon in which individuals in a social network make judgments or adopt behaviors based on the actions of others rather than their own rationality or information. Individuals match their decisions with perceived popular or prevalent trends in their social surroundings, which distinguishes this behavior and frequently results from collective influence. This usually results in a communal rise in a certain habit, such as hoarding. Increased uncertainty, shortage fear, and a desire for control all serve to magnify the psychological factors that motivate herding, which in turn intensify this behavior during the COVID-19 pandemic. The global rush to hoard toilet paper during the pandemic is an example of this phenomenon. Individuals, driven by persistent uncertainty and worry, make large purchases of toilet paper in order to exert control over a perceived necessary commodity, contributing to widespread hoarding behavior.

The perception of limited control over unprecedented events, such as the stringent COVID-19 restrictions, is positively associated with heightened stress levels. In situations characterized by

ambiguity and intensity, individuals often experience distress and a sense of helplessness [9]. Consequently, consumers tend to participate in actions that offer a semblance of ease and reassurance, often disregarding potential long-term or broader societal consequences [10]. As a result, the aforementioned theories predict that the cumulative stress from the COVID-19 pandemic will have an impact on consumer rationality. In order to feel at ease and secure during the COVID-19 crisis, people may participate in the widespread hoarding of toilet paper as a result of the stress the pandemic has caused. The normalization of escalated purchasing behaviors amid the COVID-19 epidemic contributes to consumers finding solace in both owning these crucial objects [11] and the socially endorsed nature of these behaviors [12]. Additionally, there is a noticeable shift where individuals who were initially unaffected by panic join the current trend of increased toilet paper procurement [13]. This is due to the herd externality present in observational studies. The inclination to align with socially validated behaviors online originates from the fear of social marginalization, thereby perpetuating the observed herding phenomenon. This behavioral alignment reflects a fundamental desire to conform and seek reassurance through collective actions.

3.3. Reasons on Asymmetric Information

The asymmetry in the availability of information inside digital networks contributes to an environment in which perceptions and behaviors are inextricably linked to a limited grasp of the current situation. Individuals make decisions based on fragmented information gleaned from their digital contacts, despite having an inadequate understanding of the actual situation. This dependence on incomplete knowledge is not a passive response but rather a proactive technique taken by individuals to overcome the informational gaps inherent in the unfolding circumstance. During occurrences like the COVID pandemic, where news sources are abundant online, people prefer to trust and act on numerous trends they see on social media sites, adding to global hoarding incidents.

The phenomenon of information asymmetry in digital networks, particularly during events like the COVID epidemic, is consistent with important theoretical perspectives on communication and decision-making. When confronted with little knowledge, people tend to rely on the activities of others, resulting in a cascade effect, according to the information cascade theory proposed by Bikhchandani et al. [14]. In the context of pandemic hoarding behavior, the uneven availability of information online creates a situation in which individuals, lacking entire insights into the unfolding situations, base their decisions on fragmented information obtained through digital interactions. For example, when a rumor circulated on Twitter that China would restrict toilet paper exports, the bulk of the worldwide public did not question the veracity of the news. People went so far as to collect toilet paper in the hopes that the statement would come true. This is consistent with Herbert Simon's bounded rationality principles: individuals, constrained by cognitive limits, use heuristics and simplified decision-making procedures when faced with inadequate knowledge [15]. Furthermore, Rui's strategic response to information gaps demonstrated how individuals actively engage with limited knowledge to create judgments that provide a sense of security and control in uncertain circumstances [16]. This could explain why consumers around the world hoard toilet paper without knowing the source of the information.

Overall, the interplay of different theoretical views emphasizes the complex relationship between information asymmetry across digital networks and worldwide hoarding exhibited during major events such as the COVID epidemic.

4. Suggestions

4.1. Suggestions on Unique Characteristics of Online Network

To address the challenges posed by the unique characteristics of online networks that contributed to global incidents of toilet paper hoarding during the COVID pandemic, a proactive solution entails using artificial intelligence (AI) algorithms for content moderation and data validation. This proposal is based on the observed increase in social media usage, the spread of negative sentiments online, and subsequent information cascades that cause panic and illogical decision-making.

Facebook's fact-checking project is a significant example. Facebook created a rigorous fact-checking effort, working with independent fact-checking organizations worldwide [17]. The platform used algorithms and user reporting systems to detect possibly fraudulent information. When content was flagged, it was forwarded to fact-checkers, who evaluated its accuracy [17]. Verified information was received on labels, and the spread of fraudulent or misleading content was prohibited [17]. This strategy resulted in a dramatic reduction in the spread of disinformation on the platform, removing the problem from its source. Users became more aware of the fact-checking resources accessible to them, which helped to create a more informed and discerning online community.

Implementing advanced AI algorithms capable of analyzing and flagging potentially misleading or sensational content can significantly reduce the impact of misinformation. These algorithms can identify patterns of negative sentiments and misinformation, providing users with real-time warnings and promoting critical evaluation of the content. The suggested AI-driven content moderation solution not only offers a proactive approach to mitigating the impact of misinformation but also allows for continuous adaptation and improvement. As AI algorithms learn from user interactions and evolving online trends, they can provide more accurate and nuanced assessments of information reliability.

In conclusion, leveraging advanced AI algorithms for content moderation and information validation emerges as a strategic and technologically sophisticated solution to combat the challenges posed by the unique characteristics of online networks. This approach not only empowers users with real-time information verification but also contributes to the creation of a more resilient and trustworthy online community.

4.2. Suggestions on Herding Mentality

To counteract the ubiquitous herding mentality that contributes to toilet paper hoarding during the COVID-19 epidemic, tailored psychological therapies appear to be a promising option. The evidence for this idea is a positive association between increased stress levels and the appearance of herd behavior as people seek stability and comfort in the face of uncertainty. Psychological therapies can significantly reduce stress and anxiety, breaking the pattern of herd behavior linked to toilet paper hoarding.

Kennett-Hensel et al.'s stress-induced decision-making theory emphasizes how higher stress levels affect people's engagement in activities that provide them with a sense of comfort and security [10]. Previous studies have demonstrated the effectiveness of stress-reduction interventions in a variety of situations, and they are also effective in moderating the psychological factors influencing herding behavior during the pandemic.

Evidence from studies on stress reduction therapies, such as mindfulness-based stress reduction (MBSR) programs, suggests that they may be useful in reducing stress caused by the uncertainties of the COVID-19 pandemic. These programs have been proven to improve emotional well-being and resilience, giving people coping tools that may reduce the need for herd-driven hoarding behaviors [18]. According to Sadooghiasl's research in 2022, the mean score of mental well-being in the group

with MBSR training is over 30 points higher than the control group that does not have this program [18].

Implementing psychological interventions aligns with the understanding that the perception of limited control over unprecedented events, like stringent COVID-19 restrictions, contributes to heightened stress levels. By addressing the underlying psychological factors driving herding behavior, interventions can disrupt the cascade effect of individuals aligning their choices with perceived trends, leading to a collective surge in hoarding.

In conclusion, targeted psychological interventions, specifically stress reduction programs, indicate a strategic approach to combating the herding mentality fueling toilet paper hoarding during the pandemic. By addressing the psychological factors contributing to stress and anxiety, society can mitigate the impact of herd behavior, fostering more rational and individual decision-making in times of uncertainty.

4.3. Suggestions on Asymmetric Information

To address the pervasive issue of toilet paper hoarding driven by asymmetric information, a viable solution involves implementing media literacy programs aimed at enhancing critical thinking skills among consumers. The evidence supporting this suggestion lies in the fact that individuals often fall prey to misinformation and panic-inducing narratives circulating on social media platforms. By equipping consumers with media literacy skills, they can better discern credible information from sensationalized content, reducing the likelihood of succumbing to irrational behaviors such as hoarding.

Empirical evidence supports the efficacy of digital literacy campaigns. According to research by Pennycook and Rand, people who are more capable of cognitive reflection, which includes critical thinking abilities, are less likely to be susceptible to false information [19]. Additionally, a study by Guess et al. showed that brief media literacy interventions can significantly lower people's susceptibility to false information [20].

Implementing digital literacy campaigns addresses the root cause of the issue by empowering individuals to navigate the online information landscape more discerningly. By fostering a population equipped with critical thinking skills, the likelihood of succumbing to panic-inducing information cascades diminishes. Moreover, such campaigns contribute to building a more informed and resilient society capable of making rational decisions even in times of uncertainty.

Suggesting digital literacy initiatives as a remedy is consistent with the larger realization that countering disinformation necessitates proactive steps at the individual level. This approach recognizes the transformative power of online networks and seeks to provide individuals with the tools they need to navigate the digital realm ethically. Lastly, putting in place targeted digital literacy programs shows a thorough and proactive plan for reducing the effects of information cascades, making the world's population smarter and more resilient.

5. Conclusion

Finally, this study investigated the relationship between social networks and consumer hoarding behavior, with a particular focus on the global phenomenon of toilet paper hoarding during the COVID-19 epidemic. The study filled in a big gap in the research by showing how important network science is for understanding hoarding situations. It also showed how online networks are different, how herding mentalities work, and what happens when information isn't shared equally in digital networks. The study's findings add to our understanding of consumer behavior during crises by shedding light on the interconnection of social networks, media impact, and hoarding tendencies. The study found that the distinct characteristics of online networks, the prevalence of herding mentalities,

and the asymmetry in information availability all played important roles in fueling the global epidemic of toilet paper hoarding during the pandemic. The remedies proposed in the research provide realistic techniques for mitigating the highlighted difficulties. Using artificial intelligence to moderate content and verify information accuracy, implementing targeted psychological interventions to combat stress-induced herd mentality, and promoting media literacy programs to improve critical thinking skills are all ideas that can assist people in dealing with the issues that arise during an online network crisis.

Looking ahead, this research holds potential for influencing future studies in the fields of network science, consumer behavior, and crisis management. The paper fills a research gap by emphasizing the need for a nuanced understanding of the impact of online networks on hoarding behavior, providing a foundation for further exploration in this evolving landscape. Future studies could build upon these findings to explore additional factors influencing consumer behavior, examine the effectiveness of proposed solutions, and delve into the dynamics of other crisis-induced hoarding phenomena.

Despite the contributions made by this research, it is important to acknowledge its limitations. The study focused on a specific case of toilet paper hoarding during the COVID-19 pandemic, and the generalizability of the findings to other contexts may vary. Additionally, the rapidly evolving nature of online networks and consumer behavior poses challenges in capturing a comprehensive and up-to-date picture. Future research could address these limitations by incorporating diverse case studies, exploring real-time data, and employing longitudinal approaches to track evolving patterns.

In conclusion, this paper makes an important contribution to our understanding of the relationship between social networks and consumer hoarding behavior, establishing the framework for future research and providing practical insights into how to mitigate the impact of crisis-induced hoarding inclinations. The suggested improvements and future study initiatives outlined in this conclusion are intended to help researchers and practitioners advance our understanding of the complex dynamics between online networks and consumer behavior.

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