To verify or not to verify: Using partial least squares (PLS) to predict the effect of online news on panic buying during a pandemic

Abstract

Purpose - Coronavirus disease (COVID-19) pandemic has given rise to different dimensions of uncommon human behavior, and panic buying is one of them. Interestingly, panic buying research has not been given much attention. The paper serves three purposes. Firstly, it examines the influences of the theory of planned behavior (TPB) constructs (subjective norms, attitude, and perceived behavior control) on panic buying. Secondly, it investigates online news and the perceived likelihood of being affected (PLA) as antecedents to the TPB constructs. Finally, it aims to examine online news verification as a moderator on the relationship between the TPB constructs and panic buying.

Method - Data were collected from 371 respondents and analyzed using the partial least squares method structural equation modeling (PLS-SEM). PLS predict was applied to determine the predictive power of the model.

Findings - This study found that subjective norms and attitude influence panic buying. The results further revealed that online news has a direct influence on the PLA and attitude. However, perceived behavioral control (PBC) has no such effect on panic buying. Surprisingly, online news verification also has no moderating effects on the relationships between the TPB elements and panic buying.

Originality - This research helps to understand consumers' panic buying behavior, especially during unexpected events such as the COVID-19 pandemic. This study is the first that extends the TPB incorporating both online news and PLA as antecedents to panic buying in the same model. Furthermore, the study serves as an initial attempt to investigate online news verification as a moderator between the link between three constructs of the TPB and panic buying, thus, contributing to existing literature. Lastly, it advances the body of knowledge on consumer behavior and contributes methodologically by introducing the PLS approach.

Keywords: Attitude, pandemic, theory of planned behavior, perceived likelihood, online news verification, panic buying

Introduction

The COVID-19 pandemic has created far-ranging social, economic, and geopolitical implications. At a macro level, it affected a country's gross domestic product, employment levels and threatened the survivability of companies. At a micro level, it affects an individual's way of life, daily activities, and to a certain extent, one's mental well-being (Tang, 2020b). Though vaccines have been rolled out and administered in several countries, people are still worried about the efficacy of the vaccines on COVID-19 variants, especially in some countries that are undergoing second and third waves of infections (Chong, 2020).

Not surprisingly, respective governments took unprecedented public health measures to curb the spread of this virus among the community. In China, any cities with the appearance of a handful of new cases are locked down with transportation, events, and conferences ordered to shut down (Myers, 2021). Singapore introduced a series of circuit breaker measures where individuals are asked to stay home, and cordon sanitaire is implemented (Sin, 2020). Some of these restrictions were recently lifted due to the improvement of the pandemic situation in Singapore (Sin, 2020). In Malaysia, it is no different. The government imposed a movement control order from March 2020 and was subsequently replaced by conditional movement control order. Because of the improved condition, the conditional movement control order was lifted and substituted by a less stringent recovery movement control order from June 2020 (Sia and Abbas, 2020). Unexpectedly, the second wave of infection struck the community, which saw a sudden spike in the number of confirmed cases (see Figure 1). In January 2021, the country recorded a daily new record of more than 2,000 confirmed cases, bringing the total number of confirmed cases to 138,224. This has led to a state of emergency declared in Malaysia from January 2021 till August 2021, where more restrictions on movement have been reimposed (Rodzi, 2021). Yet, the daily cases continue to increase. Coincided with the ethnic festivities, where the government allows food bazaars to operate and eateries remain open till dawn, the daily confirmed cases continued its ascending trend, resulting in 367,977 confirmed cases as of April 2021 (Kaos, 2021).

*** Insert Figure 1 ***

With these closures and lockdowns, it caused anxiety, panic, and insecurity. As the COVID-19 pandemic ripped through the economy, the livelihood of millions came under enormous stress. Such stress and uncertainty exacerbated their apprehension, leading to an uncommon human

behavior - panic buying. This is evidenced by a recent incident where Malaysians thronged hypermarkets ahead of the prime minister's announcement that another possibility of lockdown could happen to address the surging COVID-19 cases (Hassan and Anand, 2021). According to Tsao *et al.* (2019), panic buying refers to the behavior of purchasing an unusually large quantity of products caused by an event or in anticipation of an event. Other than Malaysia, panic buying induced by COVID-19 could be seen in different countries, including the United States (US), Singapore, Australia, Hong Kong, China, and Malaysia (Arafat *et al.*, 2020c).

It is therefore not surprising that the US Department of Agriculture estimated that global wheat stocks at the end of the crop marketing year in June 2020 were projected to rise to 287.14 million tons, up from 277.57 million tons a year ago, while world rice stocks were projected in 2021 at 182.3 million tons as compared to 175.3 million tons a year ago (The Straits Times, 2020a). However, such practice has an undesirable effect on society. First, it would lead to severe product shortages that can limit or prevent the most vulnerable groups, such as the elderly, from accessing essential products (Lufkin, 2020). Second, panic buying leads to price gouging, resulting in overpriced items that make them a scarcer commodity to acquire, which will exacerbate one's anxiety, helplessness, and mental distress (Lufkin, 2020).

In this regard, the COVID-19 pandemic has illuminated many of the shortcomings of our global food production and distribution system, disrupting the food supply and increasing food waste at a time when hunger is widespread and growing. Sustainable Development Goal (SDG) 3, "ensure healthy lives and promote well-being for all." SDG 8, "promote sustained inclusive and sustainable economic growth, full and productive employment and decent work for all," goes hand in hand in the battle against food loss and waste during the era of COVID-19 (Lehberger *et al.*, 2021, Wang and Hao, 2020). Therefore, the disruption to the supply chain, compounded by the negative implications of panic buying, further limits the availability of essentials to the communities that need them.

From the research perspective, panic buying is a relatively new and under-examined area in consumer behavior research. According to Yuen *et al.* (2020), a search on the Scopus database that contains "panic buying" reveals only 20 search results. Prentice et al. (2020) further spotlighted the lack of research where they indicated that empirical studies in this space are limited. Besides, only a few have examined the antecedents and consequences of panic buying (Prentice *et al.*, 2020).

Generally, most of the current published studies gravitate towards three aspects of focusing on retailers' or service providers' perspectives (Hall *et al.*, 2020, Zheng *et al.*, 2020, Tsao *et al.*, 2019), consumers' available channels for panic buying (Naeem, 2021), or on qualitative investigations into the influence of news media content on panic buying (Arafat *et al.*, 2020a, Arafat *et al.*, 2020b). Additionally, other articles such as Lufkin (2020) that attempt to explain consumer behavior behind panic buying tend to appear as opinion pieces or commentaries that are hardly backed by empirical evidence.

Considering the above, we argue that this study is timely to examine further the research gaps that existing literature has not addressed. Firstly, extant papers did not address the effects of online news, PLA, and news verification on panic buying within the same model. Digital technology has dramatically reshaped the news and media industries in the past decade. With the continued increase of internet usage, it is only natural that individuals obtain information, the latest news, and the development of events from the digital medium (Arafat *et al.*, 2020b). Research by the University of Oxford also noted that the COVID-19 crisis had caused a substantial increase in news consumption over online media (Newman *et al.*, 2021). Due to the COVID-19 pandemic lockdowns and social distancing, online platforms saw a boom in their total daily users – a 9% increase in daily traffic for Facebook (including Instagram) users, Twitter is around 11% increase, and Snapchat has experienced an increase of 20% over the last quarter's daily user level (Kitterman, 2020). Concomitantly, there are concerns about fake news, misinformation, and disinformation, that without proper verification, would create unnecessary anxiety and worry among the readers. In this regard, Loxton *et al.* (2020) elucidated that media has a significant role in influencing panic buying. In the same vein, Naeem (2021) examined the effect of posting news on social media on panic buying and concluded a significant positive relationship between both variables. On PLA, a study conducted by Loxton *et al.* (2020) clarified that panic buying is a consequence of fear of scarcity and perceived imminent threat. From the above, we can deduce that both online news and PLA are antecedents of panic buying. A systematic review by Yuen et al. (2020) identifies that panic buying results from one's fear of the unknown and their perception of the health threat. However, there is an absence of empirical evidence demonstrating how one's perception of the COVID-19 pandemic influences individuals' attitude and subjective norms towards panic buying. Considering that one's intention to act is determined by the central constructs of subjective norms, attitude, and PBC, the results of this study not only would advance the body of knowledge, but it

would also support policymakers in developing policies to mitigate excessive stockpiling in future crises.

In sum, there are three objectives of this paper. Firstly, this paper investigates the psychological factors and other determinants of panic buying. Secondly, drawing upon the literature of TPB, it explores online news and the PLA as antecedents to panic buying. Thirdly, this paper also examines the moderating effect of online news verification on the link between panic buying and subjective norms, attitude, and PBC. The rest of the paper reviews the relevant literature, develops the hypotheses, expounds on the methodology, analyzes the results, and discusses the implications, limitations, and future directions.

Theoretical Framework

Theory of Planned Behavior

Overall, existing research such as Chen *et al.* (2020) shows that consumer behavior and routine would change during a crisis. In these times, consumers often ask themselves about their buying behavior, where they buy it, and why they buy it (Yuen *et al.*, 2020). In other words, consumers will take more time to think about the necessity and rationale of their purchase decision. This behavior often results in a decrease in habitual procurements, an increase in effort in comparison shopping and searching for cheaper alternatives, reflecting an increase in extensive decision-making behavior (Loxton *et al.*, 2020). In this regard, an insightful theoretical approach to understand consumer behavior during COVID-19 is the TPB by Ajzen (1991). The central tenet of TPB gravitates around the point that behavioral intentions are determined by three elements: an individual's attitude towards the behavior, subjective norms surrounding the performance of the behavior, and the PBC (Ajzen, 1991). Within this theory, an individual attitude refers to positive or negative assessments of self-performance of a specific behavior. Subjective norms and PBC, respectively, refer to an individual's perceived social pressure and ease to perform the behavior (Ajzen, 2011). In principle, the more favorable the attitude and subjective norms, and the greater the PBC, the stronger the individual's intention to perform the behavior in question (Ajzen, 1991). Ajzen (1991) further explained that TPB had been regarded as one of the most established models to explain human behavior. It has been deployed across different contexts, including higher education (Tan *et al.*, 2020b), tourism (Fam *et al.*, 2020), green practices (Wong *et al.*, 2020), technology adoption (Lee, 2009), and e-sports (Alzahrani *et al.*, 2017).

Ajzen (2020) acknowledged that additional predictors could be included to contextualize the research. This is evident from different studies such as McMillan *et al.* (2009), where they extended TPB by including moral norms to examine schoolchildren's intention to smoke. Likewise, Li *et al.* (2018) incorporated knowledge and personal norms to understand construction waste reduction. In the same vein, there is a possibility that online news, PLA, and online news verification influence one's behavior of panic buying. As highlighted earlier, scholars such as Loxton *et al.* (2020), Naeem (2021) have spotlighted that online news and the fear of missing out can fragment the public's opinion, distort information, and influence behaviors.

Considering the above argument, it is natural to adopt TPB for this study (see Figure 2). In fact, Lehberger *et al.* (2021) have also used the TPB to examine panic buying behavior in Germany. TPB can be regarded as an insightful theoretical approach to understand consumer behaviors during the COVID-19 pandemic as it focuses on planned and conscious behavior due to environmental forces. As highlighted earlier, when the COVID-19 was declared a pandemic, there is fear of the unknown. As more cases are confirmed, additional exposure sites emerge, and conflicting messages appear over the social media, worries within people about how COVID-19 would affect them intensify, resulting in them starting stockpiling items that include perishables and hand hygiene products. Overall, it is apparent that these external factors influence the attitude, subjective norm, and control on the panic buying, making TPB the ideal theory for this study.

*** Insert Figure 2 ***

Hypotheses Development

Online News to Perceived Likelihood of Being Affected

With more than 2.4 billion internet users, it is not surprising that Forbes reported more and more individuals are seeking updates from internet sources (Kolluri and Murthy, 2021). According to Flavián and Gurrea (2008), the motivations to read news online are mainly habitual information-gathering, entertainment, and social utility. Yet, studies such as Gorvett (2020) have shown that online news is far more than a benign source of facts. From attitudes towards latest developments to the content of our dreams, the content of online news can slip into our subliminal with the possibility of us blind-spotting some of the existing risks (Kapuściński and Richards, 2016), manipulating our views of foreign nations (Jensen *et al.*, 2014), and possibly influencing the health

of entire economies (van Dalen *et al.*, 2017). Needless to say, it can aggravate symptoms of anxiety, stress, and depression (Silver *et al.*, 2013). A possible reason for this phenomenon is negativity bias, where an individual pays more attention to negative things than positive things (Baker *et al.*, 2020). This explains why individuals pay more attention to one's flaws than assets, focusing more on losses than gains and recognizing fears rather than opportunities (Goldsmith and Dhar, 2013, Galoni *et al.*, 2020). Therefore, we can sum up by saying that online news is accidentally warping our perception of reality, and it is not necessarily for the better. Considering the above arguments and following research objective two, the first hypothesis reflects our postulation that the continual presence of online news on the COVID-19 pandemic in Malaysia would inadvertently lead to individual conceiving a more than serious perception of how it would affect their daily live.

H1a: Online news of COVID-19 pandemic has a positive influence on PLA.

Online News to Attitude and Subjective Norms

Following up on earlier arguments, our next set of hypotheses revolves around the postulations that online news on the COVID-19 pandemic would affect an individual's attitude and subjective norms towards panic buying. In this regard, an earlier study conducted by Flavián and Gurrea (2009) posited that online news positively impacts attitude. Accumulating evidence has also suggested that online comments affect how individuals process information and affect their interpretations and perceptions, such that individuals tend to follow the dominant opinion (Neubaum and Krämer, 2017, Shi *et al.*, 2014). On this note, Arafat *et al.* (2020b) spotlighted that media reports play a pivotal role in panic buying. In confirming the above, Naeem (2021) conducted a study in the United Kingdom during the COVID-19 pandemic outbreak, and he revealed that information via media leads to an increase of negative emotions, and resulting in panic buying. Alalwan (2018) found this provocation especially true of pandemic and reported that posting news on social media provoked anxiety and panic buying.

Besides attitude, one's behavioral action is determined by its social groups (Ajzen, 2020). Yet, the behavior of the social groups is also dependent on the awareness of the issues. Due to the proliferation of online news on the COVID-19 pandemic, people are better informed, more engaged, and more connected. Simultaneously, some individuals may sensationalize, politicalize, and share information that otherwise may not be accurate (Kolluri and Murthy, 2021). In this aspect, Kuruppu and De Zoysa (2020) noted that excessive information and misinformation on

news media played a massive role in panic buying during the COVID-19 pandemic. Further research to support this notion was done by Prentice *et al.* (2020), and it was revealed that media such as online news has a positive influence on panic buying. As highlighted earlier and validated by many other scholars, such as Lehberger *et al.* (2021), when one is more aware of the situation on hand, it would trigger a decision-making process that guides the eventual behavior. Quite naturally, when like-minded individuals gather, it would change the social norms and expected behavior of individuals within that community. This is evident from Ramayah *et al.* (2012) where they found that the expected behavior of recycling differs from one country to another, and this quite clearly, is due to the culture and practice of the respective areas. Putting these together, it is, therefore, reasonable to expect that the presence of online news would shape one's attitude towards the COVID-19 pandemic in Malaysia, as well as changing the behavioral expectations from the group. In line with research objective two, we represent this postulation in the following hypotheses:

H1b: Online news of the COVID-19 pandemic has a positive influence on attitude towards panic buying.

H1c: Online news of the COVID-19 pandemic has a positive influence on subjective norms towards panic buying.

Perceived Likelihood of Being Affected on Attitude and Subjective Norms

PLA is a self-perceived probability of an individual being affected by a pandemic, which can be influenced by geographical locations, health conditions, and lifestyles (Tang *et al.*, 2018). Consumer psychology literature highlighted that social context is a primary factor of behavioral intention (Brooks *et al.*, 2012). When presented with shocking events (e.g., earthquake, SARS outbreak) in which foresight is limited, consumers panic and look for a social group for behavioral guidance (Brooks *et al.*, 2012). This phenomenon is evidenced in a study by Lung *et al.* (2009). The authors documented that an outbreak of an unprecedented virus such as the severe acute respiratory syndromes (SARS) can cause immense stress to the public of different age groups, professionals, and regions. When encountering environmental stress, individuals use different methods to cope, and among them, a critical coping process is a cognitive appraisal (Lung *et al.*, 2009). According to Li *et al.* (2020), cognitive appraisal involves evaluating whether an encounter is relevant to his or her well-being and, if so, to what extent. It is well documented in research that

cognitive appraisal triggers a range of emotional and behavioral outcomes. For instance, Dorfan and Woody (2011) found that an individual's appraisal of SARS transmissions resulted in several outcomes: avoidance, disgust, anxiety, urge to wash, washing duration, and wipes taken. Another study found that with knowledge and perception of a pandemic, individuals appraise the situation differently, leading to precautionary behavior (Vartti *et al.*, 2009). Yuen *et al.* (2020) elucidated individuals' perception of the threat of the health crisis was an underlying cause of panic buying behavior. From these pieces of literature, it gravitates towards two points. First, cognitive appraisal of an event can result in individuals performing activities they do not normally do. Second, a cognitive appraisal can shape one's perspective towards an event. Align with research objective two, we postulate that when individuals appraise a pandemic in terms of the likelihood they would be affected, it influences the attitude and subjective norms towards panic buying.

H2a: PLA has a positive influence on subjective norms towards panic buying.

H2b: PLA has a positive influence on attitude towards panic buying.

Attitude, Subjective Norms and Perceived Behavioral Control on Intention of Panic Buying

Attitude is defined as the degree to which a person has a favorable and unfavorable perception of a particular behavior (Ajzen, 2011). In an echoing note, Tan *et al.* (2020b) explicated that attitude impacts intention to perform or not perform a particular behavior based upon a behavioral belief regarding whether the behavior will result in desirable outcomes. Specifically, a behavioral belief can be positive if one subjectively perceives that performing a behavior will lead to a positive outcome, vice versa. Therefore, Ajzen (2020) spotlighted that "behavioral beliefs are theorized to produce a positive or negative attitude towards the behavior." Ajzen (1991) defined subjective norms as "the perceived social pressure to perform or not perform the behavior." Broadly, subjective norms are personal perceptions or opinions about what others believe the individual should do (Armitage and Conner, 2001). Subjective norms can be distinguished into injunctive normative and descriptive normative. According to Ajzen (2020), injunctive normative belief is the expectation of whether a referent group would support the execution of a particular behavior, while descriptive normative belief refers to whether the referent group would perform the same behavior as the individual. From these perspectives, we can see that both normative beliefs form the subjective norms, which have often been interpreted as social pressures from the reference group to engage in a behavior (Ajzen, 1991). Finally, PBC is referring to an individual's perceived

ease or difficulty to perform a specific behavior of which the perception is influenced by both internal (e.g., own ability) and external (e.g., environment) factors (Ajzen, 1991). In other words, PBC focuses on the presence of factors such as resources, skills, and other situational factors that facilitate or inhibit the conduct of the behavior (Ajzen, 2020).

Following TPB, the intention to act is influenced by these three central constructs. Various studies have consistently established that attitude is an essential antecedent towards behavioral intention (e.g. Wang *et al.*, 2020, Ng *et al.*, 2020). Similarly, subjective norms often demonstrate a positive influence on one's intention to adopt a particular behavior. On this note, earlier studies such as Prentice *et al.* (2020) further provided insights demonstrating that peers have a significant impact on panic buying during the COVID-19 pandemic. Further evidence to support this view can be found in Lehberger *et al.* (2021), where the authors noted that attitude and subjective norms positively influence stockpiling in Germany. Yet, PBC has been showing inconsistent results. A meta-analysis performed by Armitage and Conner (2001) explained that circumstances where herd behavior dominates or compliance to legislation is expected, PBC would not impact intention and the actual behavior. Tan *et al.* (2020b) study on mandatory campus security preparedness exercise attendance provided empirical evidence to support this notion. On the other hand, Ramayah *et al.* (2012) provided another perspective where their studies found that societal make-up plays a role in determining the effectiveness of PBC towards discharging an intended behavior. Similarly, Khoi and Long (2020) concluded that PBC positively relates to food hoarding behavior in Vietnam during the COVID-19 pandemic. Considering the above arguments and inconsistent findings on PBC, it warrants additional examination with the next set of hypotheses:

H3: Attitude has a positive influence on panic buying behavior.

H4: Subjective norms have a positive influence on panic buying behavior.

H5: Perceived behavioral control has a positive influence on panic buying behavior.

Moderating Effect of Online News Verification

While the validity of three elements of TPB is well recognized and has been widely used as a theoretical lens in analyzing consumer behaviors, many scholars have extended the theory to examine the distinctiveness of their research subjects, especially within the domain of consumer behavior. For instance, Liobikienė *et al.* (2016) included Hofstede's cultural dimensions in

analyzing green buying behavior in all European Union countries. Similarly, Lehberger *et al.* (2021) extended the TPB by including emotional stability in understanding panic buying of nonperishable food in Germany. Following this practice of extending TPB, we incorporated online news verification as a possible moderator to further advance the body of knowledge in panic buying.

Online news verification is the process of confirming whether specific news is truthful or deceptive over the internet (Kolluri and Murthy, 2021). The proliferation of online news on the COVID-19 pandemic could easily influence one's perception of an event, leading to misjudgment of the risk involved. For instance, New York city witnessed an increase in cases of people ingesting household cleaners after a piece of news was shared over social media, mentioning bleach was a possible treatment for COVID-19 infection (The Straits Times, 2020b). Similarly, the recent panic buying saw people emptying supermarket shelves of nonperishable products such as toilet paper, not because they needed them, but because they were inundated with news reports and social feeds (Bentall *et al.*, 2021). In this regard, verification of online news is essential, not only because it helps build trust in the content but also to inject a sense of sanity to reduce out-of-ordinary behavior such as panic buying. It is essential to note that research conducted on online news verification is mainly linked to fake news and media dissemination of news. Still, studies on the relationship between online news verification and panic buying are scarce. Following research objective three, we test:

H6a: Online news verification moderates the relationship between subjective norms and panic buying behavior.

H6b: Online news verification moderates the relationship between attitude and panic buying behavior.

H6c: Online news verification moderates the relationship between PBC and panic buying behavior.

Method

Participants and Procedures

Using snowball sampling, data were collected over four months, from October 2020 to January 2021. As highlighted earlier, this is a suitable period for data collection as Malaysia experienced a resurgence of COVID-19 cases, resulting in the government reimposing stricter curbs to tackle the surging cases (Shah, 2021). Responding to these impending measures, it was reported that panic buying was seen at several hypermarkets where items such as toilet rolls and vegetables were out of stock (The Sun Daily, 2021, Hassan and Anand, 2021). For the safety of our researchers, the appropriate way to collect data is through an online survey using SoGoSurvey. This platform was recognized for its ease of use, flexible design options, and strong customer service (Krut, 2021). Through SoGoSurvey, the survey form and the cover page outlining the purpose, data anonymity, and data confidentiality was created. Besides, the online platform is a valuable tool for researchers. It allows data collection from many individuals within a short period and significantly lower costs than traditional methods (Newman *et al.*, 2020). Screening questions were asked to ensure that only respondents involved in some form of purchase in Malaysia during this period participated in this study. The questions are in English, and the researchers encouraged respondents to send out the survey to their social networks to generate more responses. As such, we are not able to determine the response rate. Having said that, we received a total of 380 responses. After data cleaning, 371 valid responses remained. Table 1 shows an almost balance gender breakdown of the male at 44.7% and female at 55.3%. The majority of the respondents are 18-24 years old (47.2%), which explains why most are bachelor's degree graduates (47.7%). Based on the G*power analysis, the minimum sample size required for 80% power with six predictors and an effect size of 0.15 is 98. At 371, this represented 99.99% power, meaning that analysis can proceed. At the same time, this exceeds the minimum number of respondents recommended by Kock and Hadaya (2018) required for PLS-SEM analysis.

*** Insert Table 1 ***

Instruments

The instrument was adapted from different established studies. Six items on a 7-point Likert scale measuring attitude were adopted from Funk and Bruun (2007). A sample question includes "my

attitude towards panic buying is: good - bad." Survey items for subjective norms were adopted from Hsu and Huang (2010). They consist of three items measured on a 5-point Likert scale. Sample items include "Most people who are important to you would engage in panic buying." and, "Most people who are important to you think you should engage in panic buying." PBC was measured via a five-item instrument adapted from Hsu and Huang (2010). It is on a 5-point Likert scale with sample items such as "Whether or not to participate in campus security exercise is completely up to you."

Instruments on online news and verification of online news were adapted from Hussain *et al.* (2019). Both online news and verification of online news were measured each by five items on a 5-point Likert scale. An example of item regarding online news includes "I follow certain online news (e.g., shortage of consumables, potential price hikes, virus outbreak, etc.) reported on online media." while an example of an item on verification of online news is "I usually check the date of online news to make sure the story is up to date."

Four items for PLA were adapted from Jacobs *et al.* (2010). These items were measured on a 5-point Likert scale, and an example is "How likely do you think your current health conditions make you more affected by a pandemic?" Finally, an instrument measuring panic buying behavior was adopted from Hsu and Huang (2010). It consists of four items on a 5-point Likert scale. An example is "I buy because everyone is buying."

Common Method Bias

Given that this is a cross-sectional survey, there is a need to control for common method bias. First, the instrument has been pre-tested to remove any ambiguities, avoiding vague concepts, and keeping the questions simple, specific, and concise (Tang, 2020a, Memon *et al.*, 2017). Next, we reduced evaluation apprehension by reiterating that all responses collected are anonymized, confidential, and participation in this study is voluntary. Third, we created a temporal separation by placing the demographics questions between the predictors and the criterion, which according to Podsakoff *et al.* (2003), would make it appear that the measurement of the predictor variables is not connected with or related to the measurement of the criterion variables. Statistically, the Harman single-factor test revealed that no single component explained more than 50% of the covariance between the items and criterion constructs, indicating that common method bias is not a major concern in this study (Rodríguez-Ardura and Meseguer-Artola, 2020).

Data Analysis

We used PLS-SEM to analyze the data collected. PLS-SEM has been chosen because of its ability to work with a small sample size with no distributional assumption (Hair *et al.*, 2019). Compared to the covariance-based SEM, Kervenoael *et al.* (2020) elucidated that PLS-SEM offers greater flexibility to early-stage development types of study, which are frequently used for theory testing. Additionally, PLS-SEM has been deployed in studies of different contexts, including tourism (Mathew and Soliman, 2020), events (Tan *et al.*, 2020c), education (Sim *et al.*, 2020), and human resources (Tan *et al.*, 2020a). Considering that the proposed model has not been previously tested before, and the purpose of our research is to extend TPB, PLS-SEM is appropriate for the analysis.

Results

Measurement Model

We begin by testing the measurement model to assess the reliability and validity of each construct via convergent validity, reliability, and discriminant validity. Despite Cronbach's alpha being one of the more widely used estimators of the reliability of tests and scales, it has been criticized as underestimating true reliability (Peterson and Kim, 2013). Hair *et al.* (2017) further mentioned that Cronbach's alpha assumes that all indicators are equally reliable while PLS-SEM prioritizes the indicators according to their individual reliability. Moreover, Cronbach's alpha is sensitive to the number of items in the scale, and it tends to underestimate the internal consistency reliability (Hair *et al.*, 2017). Given these limitations, scholars like Hair *et al.* (2017), Ali *et al.* (2018), and Ringle *et al.* (2020) indicated that it is technically more appropriate to adopt a stringent alternative which is composite reliability. In this regard, Table 2 shows that the composite reliability exceeds the threshold of 0.70, and the average variance extracted (AVE) is greater than 0.50.

Most of the outer loadings were higher than the required threshold of 0.708 (Hair *et al.*, 2017). Four items were deleted due to low factor loading, resulting in an increase of its composite reliabilities and AVE above the recommended threshold. Studies such as Fam *et al.* (2020) have also seen a similar number of deleted items for not meeting the required threshold. The indicators with loadings lesser than 0.708 were retained as the minimum of AVE results, and composite reliability results were achieved (Ramayah *et al.*, 2018).

The discriminant validity is established using the heterotrait-monotrait ratio of correlations (HTMT) criterion approach. In determining the interpretation of HTMT, we took reference from the seminal work by Henseler *et al.* (2015) and Hair *et al.* (2017), where all values within the table should be lower than the threshold value. Table 3 shows the HTMT values for all pairs of constructs in a matrix format. As can be seen, all HTMT values are clearly lower than the more conservative threshold value of 0.85, indicating the discriminant validity has been achieved. Following Hair *et al.* (2017), Table 2 and Table 3 indicate that the model is valid and reliable.

** Insert Table 2**

Insert Table 3

Structural Model

Before examining the structural model, we first identify if multicollinearity exists. From Table 4, the variance inflation factor is less than 3.3, indicating that multicollinearity is not a concern in this model. Other than that, Table 4 shows the strength of the relationship between the exogenous and endogenous constructs, R^2 values that explains how much variance is explained by the independent constructs, and finally, the f^2 values, which indicate the effect of the independent constructs in producing the R^2 values.

Table 4 displays a positive significant relationship between online news of COVID-19 pandemic to PLA (H1a. β=0.308, p<0.001). At the same time, the presence of the online news regarding the COVID-19 pandemic also positively shapes one's attitude towards panic buying (H1b. β=0.126, p<0.01), but not on subjective norms towards panic buying (H1c. β=0.055, p=0.206). Hence, H1a and H1b is supported, but not H1c. On the role of PLA, the results show that it influences subjective norms (H2a. β=0.198, p<0.001), but not the attitude (H2b. β=-0.028, p=0.326). Hence, H2a is supported, but not H2b. Regarding the central constructs of TPB on panic buying, attitude (H3. β=0.210, p<0.001) and subjective norms (H4. β=0.260, p<0.001) are found to have a positive significant relationship. However, PBC did not establish any significant relationship with panic buying (H5. β=-0.117, p=0.108). Hence, H3 and H4 are supported, but not H5. Finally, the results display that verification of online news did not moderate the relationship between subjective norms and panic buying (H6a. β=-0.106, p=0.139), PBC and panic buying (H6b. β=-0.120, p=0.193) and

finally, attitude and panic buying (H6c. β=0.077, p=0.210). As such, none of the moderating hypotheses is supported.

As seen from Table 4, the R^2 value of PLA is 0.095, which means 9.5% of the variance can be explained by online news of the pandemic, which according to Cohen (1992), is considered a weak model. Similarly, we can also see that online news of the pandemic only accounts for small variances in attitude (R^2=0.015) and subjective norms (R^2=0.049). Also, we can see that the R^2 value of panic buying is 0.228, representing 22.8% of the variances accounted for by attitude, subjective norms, and PBC. Following Cohen (1992) classifications, it can be observed that online news has a negligible effect in producing the R^2 for PLA and attitude at 0.105 and 0.015, respectively, and a negligible effect in producing R^2 for subjective norms at 0.003. Similar results are observed for the effect of PLA on subjective norms at 0.037 and attitude at 0.001. Lastly, attitude (0.046), subjective norms (0.081), and PBC (0.017) have a small effect in producing the R^2 for panic buying.

Predictive Power

Predictive analytics is an essential aspect of quantitative research. Through predictive analytics, organizations can determine the likelihood of customers' responses and purchasing patterns using historical data. This study can also assess if panic buying behavior could be expected if another pandemic happens. In this regard, this study adopted the PLS predict technique advocated by Shmueli *et al.* (2019). The PLS predict technique offers a means to assess a model's out-of-sample predictive power, which assesses the model's accuracy when predicting the outcome value of new cases (Shmueli *et al.*, 2019). Following Shmueli *et al.* (2019), researchers should focus on their model's key endogenous construct rather than discussing the prediction errors in all the endogenous constructs' indicators, which in this study are the attitude, subjective norms, and panic buying. In this regard, Table 5 demonstrates that most indicators for these three endogenous constructs in the PLS-SEM analysis yield smaller prediction errors compared to the linear modeling ones, indicating a medium predictive power.

Discussions

Grounded upon the TPB, this study examines whether the exposure to online news of the COVID-19 pandemic and the act of verifying the veracity of the news influence the behavior of panic buying. It also aims to investigate whether PLA influences one's attitude and subjective norms of panic buying. Our study shows that there is a significant positive relationship between online news of COVID-19 pandemic and PLA, implying that exposure to online news influences one's perception of being affected, which makes sense considering that online news is the primary medium where one solicits information and updates (Kolluri and Murthy, 2021). This result agrees with the positive relationship between fear-arousing news messages and self-perceived risk of exposure to diseases reported by Paek *et al.* (2016). Besides, online news is also shown to positively influence attitude and subjective norms, and in turn, influencing panic buying positively. This result aligns with the TPB advocating attitude as a predictor of behavioral intention (Ajzen, 1991), which resonated with other studies on TPB, such as those of Tan *et al.* (2020b).

On the role of PLA, our results reveal that it influences subjective norms but not on attitude. Attitude is influenced by the respondents' perception of the necessity, helpfulness, and rightfulness of panic buying (Ajzen, 1991). While online news could alter one's perceptions of whether panic buying is necessary and helpful, their PLA does not significantly modify these perceptions. This can be attributed to more significant social psychological factors and other factors such as perceived supply disruption (Yuen *et al.*, 2020). This also explains why PLA has a positive relationship with subjective norms. When an individual experiences PLA, especially during a pandemic, the individual develops a set of unusual psychological response of being tribalistic. This is where they would seek comfort and direction from a group that he/she is comfortable with, which eventually triggers a conformist behavior where the perception of breaking social norms can have harmful, unintended consequences (Robson, 2020). This explains why not wearing a mask in public or not visiting a doctor when developing flu syndromes during this period of the COVID-19 pandemic can be seen as disobeying social norms, putting themselves and others in danger. Another plausible reason for such behavior is that PLA reinforces herd mentality, which propels panic buying. For instance, people are quick to fall into the behavior of panic buying during a crisis, whether they are exposed to online news probably due to peer pressure and the fear of losing out. This behavior is aggravated when they perceive a high likelihood of being affected by

the crisis. It aligns with studies showing that perceived risk and subjective norms are significant predictors of intention to engage in a particular behavior (Ho *et al.*, 2017, Gong *et al.*, 2019, Tan *et al.*, 2020b, Quintal *et al.*, 2010). However, very few studies show PLA as a mediator of subjective norms, which confers novelty to the findings of this study.

Our results show that out of the three central constructs of TPB, only attitude and subjective norms display a significant relationship with panic buying behavior. This result is in line with the social or herd psychology reported by multiple authors that panic buying is partly due to social pressure (Naeem, 2021, Lehberger *et al.*, 2021, Arafat *et al.*, 2020c, Yuen *et al.*, 2020). As with the other cited literature, the perceived social pressure or subjective norms from the significant others promote panic buying behavior.

Interestingly, neither online news verification nor PBC shows a significant influence on the behavior of panic buying. This result is contrary to Park and Dhandra (2017) finding where they indicated that dispositional mindfulness, which includes verification of news, is negatively related to impulsive buying. Our results show that this conscious act does not seem to moderate the behavior of panic buying. Having analyzed media reports, Arafat *et al.* (2020a) found a sense of scarcity to be the main reason triggering panic buying followed by increased demand, the importance of a product, an expected increase in price, and a lesser extent, COVID-19. Therefore, we argue that a perceived sense of scarcity had an overriding effect among the study's participants who tended to verify online news. The sense of scarcity could stem from panic buying as a herd behavior induced by a pandemic as COVID-19.

Another probable reason could be when the participants perceived that panic buying could result in increased demand and a possible shortage of supply, it triggers a sense of fear of missing out. In other disaster conditions like a flood, individuals can prepare as they know how many supplies are needed, but COVID-19 is an unprecedented pandemic that no one has experience. Wang and Hao (2020) observed the prevalence of food hoarding during the outbreak of COVID-19 and showed that the behavior could be categorized as rational and irrational where the amount of food available drove the former and the likelihood of being affected by COVID-19 and the latter was primarily a result of herd psychology. Whether rational or irrational, it was evident in our study that PBC has insignificant influence compared to other constructs of TPB.

Theoretical Implications

This study contributes to the literature in different ways. First, this study extended the TPB by including other constructs such as the role of online news, PLA, and online news verification to understand the motivation behind panic buying. Second, our study addresses a critical research gap demonstrating that herd psychology dominates panic buying behavior, attested by the significant correlation between subjective norms and panic buying. Arguably, this seems to be the most important contribution, considering the lack of literature in this domain (Prentice *et al.*, 2020). This study also shows a significant positive correlation between PLA and subjective norms, which are commonly treated as separate predictors of behavioral intention or as moderators of other correlations in previous TPB studies (Kervenoael *et al.*, 2020). It suggests that PLA could positively affect or reinforce subjective norms, an important manifestation of herd psychology. This study reveals that though attitude and PLA are affected by online news, PLA does not influence attitude. It implies that online news could affect one's beliefs and awareness, which constitutes one's attitude, and the accuracy of the online news is quintessential in shaping desirable attitudes. Once attitude is shaped, it does not seem to be shaken by PLA.

Unlike other studies that adopt the perspective of the supplier during panic buying (Zheng *et al.*, 2020) or developing a conceptual model of panic buying (Naeem, 2021), this study adds value to the literature by developing a model examining the interplay of online news, PLA, news verification and constructs of TPB and panic buying model. In that respect, this study answers the call by Campbell *et al.* (2020) to include a range of factors and other mediating mechanisms such as the emotions associated with the appraisal of external factors that could be explored better to understand the causes and effects of irrational buying behaviors. Finally, our result reinforces the notion that during a pandemic situation where one has no foresight or experience, one may over-rule by the fear of missing out, behaving in a radical manner that does not usually will.

Practical Implications

From our results, we argue that it is crucial to regulate the integrity of online news, which needs to be done at the level of the authorities. Given that online news influences one's PLA, which in turn drives the attitude and subjective norms towards panic buying, relevant authorities should take a proactive approach in screening and keeping an eye on the news on popular online media to confer a realistic PLA to the public (Wang and Hao, 2020). Noting that the act of verifying online

news does not significantly moderate the behavior of panic buying, we posit that once ingenuine news begins to spread online, it could be hard to affect the PLA and subjective norms of the general public. As such, regulation of the truthfulness of online news should be made at the onset of a pandemic or a crisis. Besides, online news tends to affect one's attitude towards panic buying, and attitude is a complex manifestation of one's beliefs, awareness, values, and evaluation outcomes (Zhao *et al.*, 2020). In this regard, we reiterate the importance of controlling the authenticity of online news and suggest educating the public through multiple channels to impart the desired beliefs and awareness. Also, we opine that regulating online news is a process, which governments can continuously improve by channeling the public to an official website containing accurate news and updates about a crisis such as COVID-19. The authorities can address concerns such as the adequacy of resources to prevent panic buying and clarify false news about the crisis as soon as it arises. Additionally, knowing that panic buying is likely to occur in a crisis, suppliers and retailers can adjust their stock inventory to ensure minimal supply chain disruption and sufficient supply of essential items during the crisis.

While it is crucial to confer realistic PLA to the public through measures to monitor or control the accuracy of online news, it is equally important to address the tendency of falling into subjective norms by ensuring sufficient supplies of the essentials and purchase control by the retailers to reduce stockpiles. This often requires effective management of the supply chain and close cooperation of the authorities with suppliers and retailers in alleviating the impacts of subjective norms (Yuen et al., 2020). Besides, the fears leading to subjective norms such as scarcity and price hikes could be addressed to alleviate subjective norms. This also relies on good governance in ensuring sufficient supplies and fair prices (Arafat *et al.*, 2020c). Additionally, knowing that panic buying is likely to occur in a crisis, suppliers and retailers can adjust their stock inventory to ensure minimal supply chain disruption and sufficient supply of essential items during the crisis.

Besides, online news tends to affect one's attitude towards panic buying, and attitude is a complex manifestation of one's beliefs, awareness, values, and evaluation outcomes. In this regard, we reiterate the importance of controlling the authenticity of online news and suggest educating the public through multiple channels to impart the desired beliefs and awareness. Also, we opine that regulating online news is a process, which governments can continuously improve by channeling the public to an official website containing accurate news and updates about a crisis such as

COVID-19. To achieve this, governments can use the media, being a double-edged sword, to advertise the official sources where the public could obtain reliable information and educate the public on the danger of spreading unverified online news. The authorities can clarify false news about the crisis as soon as it arises while enacting regulations on creating and spreading false news.

It has emerged from this study that understanding the underlying mechanisms of how online news leads to the behavior of panic buying has important socio-economical implications. It enables more effective upkeeping of social order by promulgating that online news should be regulated to confer a realistic PLA, affecting subjective norm, hence panic buying (see Table 3). It permits policymakers to better plan for preventive and corrective actions in the event of a pandemic to ease the social stress stemming from erratic behaviors due to online news while maintaining sound pandemic control measures crucial for public health. It also contributes to continuous supplies of the essentials to minimize disruption to daily activities and optimize productivity, even during a crisis. It can also serve as a scientific basis for the authorities to educate the public on the importance of adopting a realistic PLA upon receiving unverified online news, sometimes involuntarily, and not to fall into herding psychology when seeing others engaged in panic buying. It could also be a basis for the public to positively influence those intended to participate or are participating in panic buying. Once the circuit of subjective norms is broken, it will not lead to panic buying (see Table 4).

Limitations

This study endeavored to recruit as many respondents as possible from different states of Malaysia. However, as the responses to the survey were voluntary and snowball sampling also contributed to the collection of responses, it was unlikely to get an equal number of respondents from each state of Malaysia. For the same reason, the control of the demographic profile of the respondents has been challenging. The limitations in getting geographically and demographically balanced samples could result in over-representation and under-representation of the samples.

As this is a cross-sectional study, it does not capture the change in the respondents' perception over time. The attitude, PBC, subjective norms, and PLA may likely change as the pandemic progresses, for instance, before, during, and after lockdowns and with increasing hope for vaccines. These changes are not meant to be captured in this study which was designed to be cross-sectional (Levin, 2006). This study is subject to response biases. Though efforts have been made to reduce CMB,

we cannot deny that respondents may provide socially desirable responses. Besides, in instances where the respondents cannot relate to the survey items, they tend to opt for the "middle ground" (Podsakoff et al., 2003). Future studies can adopt longitudinal studies or multiple waves of data collection to examine these changes. While this study examines the interplay of online news, PLA, the act of verification, and the conventional constructs of the TPB in predicting behavioral intention, it seems that there are other prominent variables at play, particularly the sense of scarcity and insecurity and social psychological factors. This study has not attempted to include all variables affecting panic buying, which would require extensive effort. Within the retailer perspective, comparing pre- and post-disaster consumption behavior, based on household transaction data, could lead to deeper insights into buying tendencies. Future researchers could examine this aspect as results could help in understanding how consumption behaviors converge or diverge when conditions normalize and also what to expect when the next pandemic happens again.

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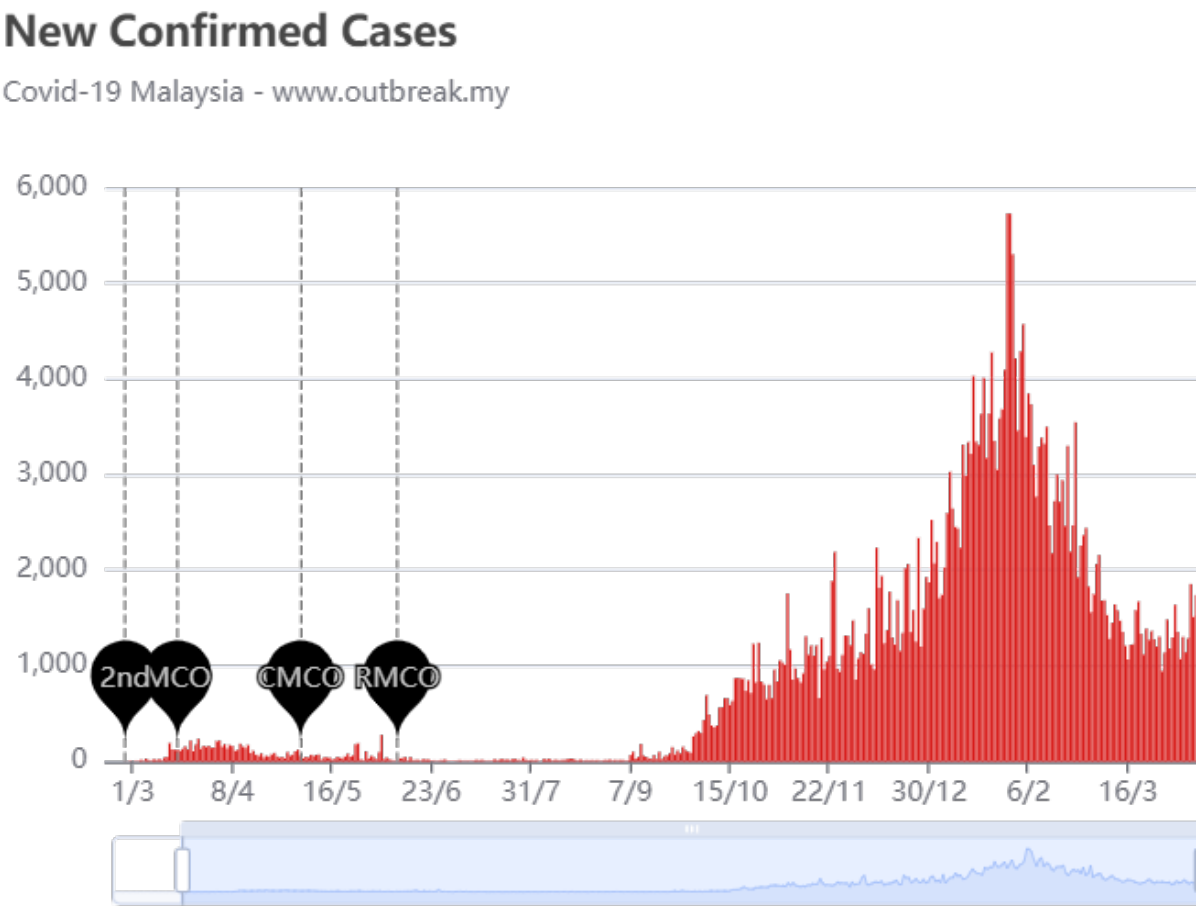

Figure 1: New confirmed cases in Malaysia from 1st March till 10th April 2021

Source: Outbreak Malaysia (2021), "New confirmed cases", available at: https://www.outbreak.my/ (accessed 14 April 2021).

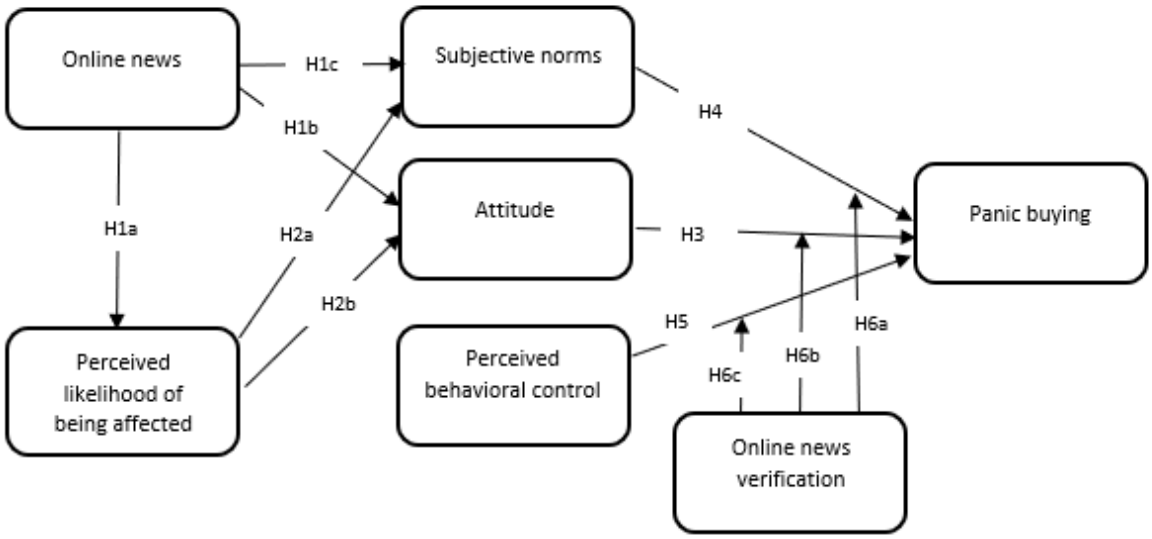

Figure 2. Conceptual model

Table 1. Demographic profiles of respondents

Demographic Variable	Category	Frequency (n=371)	Percentage
Gender	Male	166	44.7
	Female	205	55.3
Level of Education	Doctorate	12	3.2
	Master	63	17.0
	Bachelor	177	47.7
	Diploma	18	4.9
	Foundation	67	18.1
	Others	34	9.1
Age	18-24 years old	175	47.2
	25-34 years old	55	14.8
	35-44 years old	89	24.0
	45 and above	52	14.0

Table 2. Measurement Model

		Outer Loading	CR	AVE
ATT1	My attitude toward panic buying is: Bad - Good.	0.819	0.938	0.752
ATT2	My attitude toward panic buying is: Unfavorable - Favorable.	0.912		
ATT3	My attitude toward panic buying is: Dislike - Like.	0.891		
ATT4	My attitude toward panic buying is: Bored - Excited	0.864		
ATT5	My attitude toward panic buying is: Unenjoyable - Enjoyable	0.848		
ON1	I have easy access to online news (e.g. shortage of consumables, potential price hikes, virus outbreak, etc.) on online media.	0.689	0.890	0.620
ON2	I follow certain online news (e.g. shortage of consumables, potential price hikes, virus outbreak, etc.) reported on online media.	0.817		
ON3	I follow online news (e.g. shortage of consumables, potential price hikes, virus outbreak, etc.) reported on online media that is relevant to my life.	0.874		
ON4	I find that online media provide important information about what is happening around us.	0.754		
ON5	I follow online news (e.g. shortage of consumables, potential price hikes, virus outbreak, etc.) from online media regularly.	0.790		
ONV1	When in doubt, I check the source of online news content.	0.705	0.818	0.534
ONV2	I always read the contents of online news, not just the headlines.	*removed*		
ONV3	I usually check the date of online news to make sure the story is up to date	0.603		
ONV4	I cross-check online news against official media.	0.874		
ONV5	I seek expert opinions on the authenticity of an online news.	0.714		
PB1	I buy because everyone is buying.	0.839	0.804	0.518
PB2	I shop in the supermarket without thinking much.	0.491		
PB3	I buy food and non-food items more than what I normally bought.	0.851		
PB4	I buy according to how I feel.	0.634		
PBC1	I have enough money for panic buying.	*removed*	0.850	0.657
PBC2	If I wanted to, I could engage in panic buying.	*removed*		
PBC3	I have complete control over panic buying.	0.905		
PBC4	Whether or not I engage in panic buying was entirely up to me.	0.681		
PBC5	I have complete control over whether I want to engage in panic buying.	0.829		
PLA1	How likely do you think it is that a pandemic will occur in the area you live in?	*removed*	0.801	0.574
PLA2	If a pandemic occurs in the area you live in, how likely do you think you or your family would be affected by it?	0.748		
PLA3	How likely do you think your current health conditions make you more affected by a pandemic?	0.707		
PLA4	How likely do you think your current lifestyle makes you more affected by a pandemic?	0.813		
SN1	Most people who are important to you think you should engage in panic buying.	0.909	0.934	0.825
SN2	The people in your life whose opinions you value would approve your engagement in panic buying.	0.928		
SN3	Most people who are important to you would engage in panic buying.	0.887		

Note: (1) ATT – Attitude; ON – Online news; ONV – Online news verification; PB – Panic buying; PBC – perceived behavioral control; PLA – Perceived likelihood of affected; SN – Subjective norms

Table 3. Discriminant validity

	ATT	ON	PLA	PB	PBC	SN
ATT						
ON	0.125					
PLA	0.106	0.388				
PB	0.440	0.160	0.237			
PB	0.199	0.176	0.111	0.202		
SN	0.561	0.119	0.278	0.472	0.146	

Note: (1) ATT – Attitude; ON – Online news; ONV – Online news verification; PB – Panic buying; PBC – perceived behavioral control; PLA – Perceived likelihood of affected; SN – Subjective norms (2) HTMT achieved at $HTMT_{0.85}$

Table 4. Structural Model

	Hypotheses	Std Beta	Std Error	t-value	VIF	f^2	R^2	Q^2
H1a	ON -> PLA	0.308	0.046	6.618***	1.000	0.105	0.095	0.048
H1b	ON -> ATT	0.126	0.053	2.375**	1.105	0.015	0.015	0.009
H1c	ON -> SN	0.055	0.067	0.820$^{(NS)}$	1.105	0.003	0.049	0.038
H2a	PLA -> SN	0.198	0.060	3.301***	1.101	0.037	-	-
H2b	PLA -> ATT	-0.028	0.062	0.452$^{(NS)}$	1.105	0.001	-	-
H3	ATT -> PB	0.210	0.049	4.277***	1.369	0.046	0.228	0.113
H4	SN -> PB	0.260	0.056	4.677***	1.354	0.081	-	-
H5	PBC -> PB	-0.117	0.094	1.237$^{(NS)}$	1.029	0.017	-	-
H6a	SN*ONV -> PB	-0.106	0.098	1.086$^{(NS)}$				
H6b	PBC*ONV -> PB	-0.120	0.139	0.865$^{(NS)}$				
H6c	ATT*ONV -> PB	0.077	0.096	0.806$^{(NS)}$				

*Note: (1) ATT – Attitude; ON – Online news; ONV – Online news verification; PB – Panic buying; PBC – perceived behavioral control; PLA – Perceived likelihood of affected; SN – Subjective norms (2) NS – Not significant; *p<0.05, **p<0.01, ***p<0.001*

Table 5. PLS predict

Constructs	Indicators	PLS		LM		PLS-LM	
		MAE	Q^2_predict	MAE	Q^2_predict	MAE	Q^2_predict
Attitude	ATT2	1.241	0.007	1.217	0.015	0.024	0.015
	ATT3	1.217	0.004	1.189	0.013	0.028	0.013
	ATT4	1.294	0.015	1.283	0.018	0.011	0.018
	ATT1	1.293	0.001	1.299	-0.013	-0.006	-0.013
	ATT5	1.231	0.006	1.205	0.010	0.026	0.010
Panic Buy	PB4	0.879	0.003	0.865	-0.001	0.014	-0.001
	PB1	0.893	0.033	0.883	0.021	0.010	0.021
	PB3	0.922	0.032	0.919	0.041	0.003	0.041
Subjective Norms	SN2	0.889	0.003	0.877	-0.008	0.012	-0.008
	SN1	0.897	0.003	0.881	-0.005	0.016	-0.005