Antecedents and consequences of panic buying: The case of COVID-19

Dr Catherine Prentice

Associate Professor of Marketing

Department of Marketing

Griffith Business School

Griffith Institute for Tourism

Griffith University,

griffith.edu.au

email: cathyjournalarticles@gmail.com

ORCID: 0000000277003889

Dr Sara Quach

Lecturer of Marketing

Department of Marketing

Griffith Business School

Griffith University, Australia

s.quach@griffith.edu.au

Dr Park Thaichon

Senior Lecturer of Marketing

Department of Marketing

Griffith Business School

Griffith University, Australia

p.thaichon@griffith.edu.au

Dr Catherine Prentice is an Associate Professor of Marketing, Director of Research at Department of Marketing, Griffith University, Australia, and the director of Asia Pacific Association for Gambling Studies. Prior to her academic career, Catherine had worked in various industries for over a decade as a business owner and as a senior corporate executive. She has published extensively in top-tier marketing and management journals. Her main research interests include service research, consumer psychology, consumer behavior, artificial intelligence, emotional intelligence, services and relationship marketing, and gambling studies. She currently serves as

Associate Editor of Service Industries Journal, Associate Editor of Tourism Review, and Associate Editor of Journal of Global Scholars of Marketing Science

Sara Quach Thaichon is a Lecturer in the Department of Marketing, Griffith University, Australia. Her research interests are in the areas of services marketing, marketing research, consumer behaviour and relationship marketing. Sara has won and worked on a number of research grants and international consulting projects with her with the team within and outside the Department of Marketing, Griffith University.

Dr Park Thaichon is the Program Director of the Master of Marketing and the Cluster Leader of the Relationship Marketing for Impact research cluster, Griffith Business School. He is a member of Griffith Institute for Tourism and Griffith Asia Institute. His research, teaching and consulting focus is around relationship marketing, digital marketing, technology, and consumer behaviour.

The data that support the findings of this study are available from the corresponding author upon reasonable request.

DR. CATHERINE PRENTICE (Orcid ID : 0000-0002-7700-3889)

Article type : Original Article

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Abstract

Panic buying emerged as a significant phenomenon during the COVID-19 pandemic. This study draws on the scarcity principle, crowd psychology, and contagion theory to investigate the antecedents and consequences of panic buying. The antecedents included in this study are government measures, media and peer influence, and the fear of missing out. The consequences are founded on a sense of security and guilt. Retailer intervention is included as a moderator to the proposed main effects. Data were collected from 341 consumers who engaged in panic buying and were residents of the United States and Australia during the COVID-19 pandemic. Structural equation modelling (PLS-SEM) was employed to test the proposed model. The results show that the proposed antecedents (except fear of missing out) were significantly related to panic buying, which in turn had a significant influence on panic buyers' psychological outcomes. The moderating effects of retailer intervention varied across different product categories. Discussion and implications of these findings are provided for policy makers, customers, and practitioners.

Keywords: COVID-19; panic buying; consumer behaviour; public policy; social media; interventions; crowd psychology

10500 words

1. Introduction

The COVID-19 pandemic has exerted an unprecedented impact on almost every aspect of society. Governments have imposed various measures to combat the spread of the disease. These measures have had significant impact on the economy and politics at the macro level and have affected mental wellbeing and the daily lives of individuals on a micro-level (Kan & Drummey, 2018). The pandemic continues with no confirmation of publicly available vaccine. Such uncertainty leads to high levels of anxiety, chronic distress, and excessive behaviours for the society at large. Panic buying is one manifestation of this response to increasing uncertainty.

Panic buying refers to the act of purchasing unusually large amounts of products due to a prediction of supply disruption caused by a severe disaster or crisis (Tsao, Raj & Yu, 2019). During the COVID-19 pandemic, Roy et al. (2020) revealed that approximately one-third of customers had the urge to buy and stockpile essentials at home. Panic buying has a negative impact on society and the economy in the long term (Prentice, Chen & Stantic, 2020). Understanding the causes of panic buying is imperative to managing a crisis since such behaviour can result in unexpected consequences (Tsao, Raj, & Yu, 2019; Zheng, Shou, & Yang, 2020). Studies have indicated that measures taken by the government to combat the pandemic, such as social distancing, quarantine, and lockdowns may be related to panic buying (Prentice et al., 2020). Excessive posts on stockpiling in social media by friends, relatives, and unacquainted others may also enhance the fear of missing out and prompt panic buying (Roy et al., 2020). Empirical studies in this space are limited. Published studies predominantly focus on the retailers' reactions to stockpiling (e.g. Tsao, Raj, & Yu, 2019; Shou, Xiong, & Shen, 2011; Zheng, Shou, & Yang, 2020), consumers' options for shopping channels (e.g. online or physical stores) (Mehrolia, Alagarsamy & Solaikutty, 2020), or qualitative investigations into panic buying and media communications during crises (e.g. Ding, 2009; Jinqiu, 2003; Wei, Zhou, & Zhou, 2011).

Drawing on resource scarcity, contagion theory, and crowd psychology, this study examines how government measures, social media and peer influence, and the fear of missing out (FOMO) are associated with panic buying. Resource scarcity can be a key reason for panic buying (Yoon, Narasimhan, & Kim, 2018). In the case of a health crises, where there is often a surge in demand for essential items, customers tend to seek relevant cues to decide whether they should stockpile (Cannon, Goldsmith, & Roux, 2019). Crowd psychology theory indicates that maladaptive crowd behaviour in emergencies and disasters such as

stockpiling or panic buying often result from psychological weakness (Drury, Novelli, & Stott, 2013). The phenomenon of panic stockpiling can also be elucidated by contagion theory where emotions and behaviours spread through the mechanism of "contagion" (LeBon, 1960). The use of multiple theoretical lenses can enrich the understanding of the motivation and effects of panic buying. An understanding the consequences of panic buying is important for researchers and practitioners wishing to address panic buying, although research has predominantly focused on retailers' profit (Zheng, Shou, & Yang, 2020) and overall shortage and social unrest (Tsao, Raj, & Yu, 2019). The impact of panic buying on individual consumers has not been sufficiently studied**.**

This study takes a holistic perspective to address the antecedents and consequences of panic buying. Understanding these relationships has implications for policymakers to evaluate the effectiveness of intervention measures and for retailers to develop appropriate contingent marketing strategies. This study also provides insights into consumer psychology and public policy research. This paper is organised as follows. First, we review the literature and offer hypotheses, followed by an explanation of the methodological and empirical procedures used to test the hypotheses. Discussion of the results and pertinent theoretical and managerial implications conclude the paper.

2. Literature review and hypotheses

2.1 Preventive measures and panic buying

Panic buying can be an outcome of a sense of resource availability (e.g. scarcity vs. profusion) (Mehta & Zhu, 2016). Consumers are exposed to contextual cues that may indicate resource scarcity, which affects attitudes and subsequent behaviour (Chandran & Morwitz, 2005). A resource is defined as "any quantifiable entity that offers utility to the individual and has the potential to be depleted or consumed" (Cannon, Goldsmith, & Roux, 2019, p. 105). There are many types of resources, for example, money (Fernbach et al., 2015), food (Petersen, Aarøe, Jensen, & Curry, 2014; Zhu & Ratner, 2015), products (Zhu & Ratner, 2015), and time (Fernbach et al., 2015; Shah et al., 2012). Resource scarcity is defined as "the perceived supply level of physical resources that are required for an individual's normal growth and maintenance" (Mehta & Zhu, 2016, p. 768). Building on Ellis, Figueredo, Brumbach, and Schlomer's (2009) work, Griskevicius, Tybur, Delton, and Robertson (2011) conceptualised resource scarcity as "the availability of energetic resources and level of competition for these resources" (p. 1016). In general, resource scarcity refers to

a perceived state of unfavourable discrepancy between one's existing level of resources and a greater, more desirable reference point (Cannon, Goldsmith, & Roux, 2019).

The perception of resource scarcity can be triggered by an assessment of individual-level resources, for example, one's current income or property (Shah et al., 2015), or macro-level resources, such as a shortage of supply (Tsao, Raj, & Yu, 2019). Resource scarcity can trigger anticipated regret which is a feeling experienced when one compares expected consequences associated with a decision not to act, with outcomes that would have been realised should one have decided to act (Loewenstein & Lerner, 2003; Hatak & Snellman, 2017). Making a purchase can be considered a coping strategy to address perceived scarcity and may mitigate the regret associated with future shortages. Mehta and Zhu (2016) indicated that consumers' exposure to situational cues can prompt a perception of resource scarcity, thereby influencing mindset and behaviours. When customers feel nervous about the current circumstances, they are more likely to be sensitive to wider social patterns such as the state of the economy and government reactions as they are indicators of the allocation and availability of resources (Cheng, 2004).

Public health risk mitigation measures that have been taken to control the spread of the COVID-19 virus, such as lockdowns and social distancing, referred to as government measures in this study, can influence stockpiling behaviour in times of crisis. Under these circumstances, the belief that one must stay at home for an uncertain period of time can form the misperception that supply will become disrupted and make resources hard to access. The perceived resource scarcity results in customers flocking to bulk buy products, which in turn creates a significant increase in demand, opportunistic stocking, and eventually leads to actual scarcity (O'Brien, Moore, & McNicholas, 2020). For example, the Vietnamese government announced on 31 March 2020 that 15 days of national social distancing would start from Wednesday 1 April 2020. As a result, many people rushed to stockpile essential items, causing long queues at supermarkets and grocery stores the night before the rules were implemented (Dung, 2020). This also happened in March 2020 when the Indian prime minister announced the country was to lockdown for 21 days (BBC, 2020). On the basis of the foregoing discussion, it is hypothesised that:

H_1: Government measures for combating the COVID-19 pandemic have a significant positive effect on panic buying.

2.2 Media influence and panic buying

Panic buying of necessities during a health crisis is considered "following the crowd" or "going with the flow" (Cheng, 2004). Crowd behaviour can be delineated in news and social media conversations. The stories of stockpiling and images of empty shelves circulated by the media might suggest that others are only watching out for themselves, hence provoking a desire to follow the same behaviour, such as stocking up on supplies (Van Bavel, 2020). It is proposed that crowd psychology can lead to loss of behavioural control, self-interest, and disorder (Chertkoff & Kushigian, 1999; Drury, Novelli, & Stott, 2013). During emergencies and disasters, a crowd can become a channel for intrinsic tendencies towards dysfunctional acts, false attitudes, and social malfunction (Smelser, 1962; Strauss, 1944). It often starts with individuals sensing a failure in some element of the social system, such as the threat of product shortages, which prompts individuals to examine the current situation, observe the reactions of others, and subsequently form a common belief within the crowd (Earl, 2008).

Crowd psychology can also be explained by the use of social proof heuristics as a shortcut in the consumer decision-making process (Avery & Teixeira, 2016). Social proof is rooted in the principle of social validation, which refers to the idea that individuals monitor how others think and behave, and then act accordingly. The shopping behaviour observed in media communications including official news and social media often serves as a signal of crowd behaviour (Smith & Klemm, 2020). As a result, consumers adopt this social proof heuristic to refresh their beliefs related to their purchase behaviour such as the amount and frequency of purchase (Zheng, Shou, & Yang, 2020). Social media messages such as the toilet paper crisis and images of empty shelves in supermarkets sends a signal of scarcity to the public (Raj & Yu, 2019). This is especially true when customers are experiencing time and information constraints, as may be experienced during a pandemic (Cialdini & Goldstein, 2002). During the SARS pandemic in 2003, reports of the outbreak through Web sites and text messages triggered waves of mass panic buying in China (Ding, 2009). Cheng (2004) suggested that watching too much SARS news coverage lead to a diffusion of fear and negative feelings which prompted the stockpiling behaviour. Roy et al. (2020) also indicated that news of shortages in essential items circulated by the media further strengthened panic buying behaviour. Hence, we propose the following hypothesis:

H_2: Social media posts on the COVID-19 pandemic has a significant positive effect on panic buying.

2.3 Peer influence on panic buying

Contagion theory can explain "mass panic" which refers to an exaggerated or excessive fear spreading through "contagion" (Drury, Novelli, & Stott, 2013). Contagion is the "process by which a person or group influences the emotions or behaviour of another person or group through the conscious or unconscious induction of emotion states and behavioural attitudes" (Schoenewolf, 1990, p. 50). Panic buying is considered a 'mass panic' behaviour which is driven by incomplete information and limited choices available to the public in the middle of a crisis (Canter, 1990).

Contagion can happen via both unconscious and conscious pathways. It is suggested that individuals unconsciously mimic the expressions and behaviours of those they directly interact with in conversations (e.g., Bavelas, Black, Lemery, & Mullett, 1987; Bernieri, Reznick, & Rosenthal, 1988). Contagion can also happen through a conscious cognitive process as individuals become sensitive to the feelings of others (Bakker & Schaufeli, 2000). This occurs when an individual intends to envisage their experience in the predicament of the other, especially those whom they have direct contact with, and, as a result, are consumed with the same emotions. Contagion theory suggests that individuals engage in a process of social learning by examining and imitating the actions of peers under conditions of uncertainty (DiMaggio & Powell, 1983). In the context of panic buying, the realisation of others' fears and anxieties about large scale stock-outs may trigger similar emotions and lead to excessive purchase behaviours. Especially as consumers' buying decisions can be influenced by their peers such as their family, friends, and other shoppers (Zheng, Shou, & Yang, 2020) and has been observed in previous disasters and crises. For example, in the New Jersey snowstorm of 2015, some customers decided to stockpile after seeing long queues at grocery stores and supermarkets, which pressured them to do the same (Tuttle, 2015). As the number of customers who stockpiled accumulated, others feel greater panic, thereby resulting in large-scale stock-outs (Zheng, Shou, & Yang, 2020). During interactions with family, friends, and shoppers, feelings of fear and anxiety may spread, inducing panic and associated behaviours including stockpiling. Therefore, the following hypothesis is proposed:

H_3: Peers' panic buying behaviours have a significant positive effect on panic buying.

Contagion theory also lends support for the urge to stay connected with what other people are doing, which is commonly referred as the fear of missing out (Przybylski et al., 2013; Chen, Kazman, & Matthes, 2015). The fear of missing out (FOMO) is defined as the "...pervasive apprehension that others might be having rewarding experiences from which

one is absent" (Przybylski et al., 2013, p. 1841). FOMO prompts an individual to monitor the behaviours of others. Extant research has empirically confirmed the relationship between FOMO and engagement in misbehaviour on account of the need to be constantly informed of experiences that others are having and the desire to follow (Baker et al., 2016; Elhai et al., 2016; Oberst et al., 2017; Riordan et al., 2018). During a health crisis, news about supply stockpiling and hoarding were continuously circulated on traditional news channels and social networking sites such as Facebook and Twitter. Individuals were frequently reminded of purchases they might be missing out on. It is, therefore, proposed that FOMO can increase panic buying. Furthermore, Riordan et al. (2018) also suggests that FOMO stems from a shortfall in psychological need satisfaction such as the lack of resources in a pandemic. FOMO may exacerbate panic buying behaviour and serve as an avenue to cope with the ongoing uncertainty (Hatak & Snellman, 2017; Luo, Lu, & Li, 2019). On the basis of this discussion, we posit:

H_4: The sense of fear of missing out has a significant positive effect on panic buying.

2.4 Panic buying and sense of security

In a pandemic, the threat of risk becomes ever more present and individuals employ different mechanisms to maintain ontological security or a "sense of coherence and continuity in the face of uncertainty" (Armstrong-Hough, 2015, p.385). This is an emotionally charged concept (Van den Bos, 2009). A crisis such as a pandemic or natural disaster is characterised by significant risks and high levels of uncertainty, including supply shortages. Panic buying is considered a response to the anticipation of resource scarcity because a large-scale stock-out caused by a pandemic can further intensify insecurity and fear that the shortage will never end (Hatak & Snellman, 2017). As such, the main motivation for stockpiling supply is to secure the future of one's family. The feeling of security can be conceptualised as the result of the interplay between one's current objective state and the subjective perception of the future outcomes in relation to access to resources following one's action (Muñoz de Bustillo & De Pedraza, 2010). When consumers stockpile a product, they are likely to feel more confident about their future as the resource scarcity is no longer a concern. On this basis, we propose the following:

H_5: Panic buying has a significant positive effect on a buyer's sense of security.

2.5 Panic buying and sense of guilt

Panic buying as a response to an anticipated shortage can cause actual scarcity in the market due to a surge in demand which the supply chain is not able to cope with (Zheng, Shou, & Yang, 2020). It can disrupt the entire supply chain and exert a detrimental impact on the market (Bekiempis, 2020). Stockpiling means that many customers, especially those most vulnerable, such as the elderly, will not be able to access essential resources such as food and household items (Forsberg, 2020). Hoarding has received widespread criticism from the public and hoarders have been condemned in all forms of media (Siebert, 2020). Stockpilers are more likely to feel guilty which is an affective reaction following public disapproval of some misconduct (Tangney et al., 1996; Vess et al., 2014). Guilt is a popular form of emotional distress which is experienced after a violation of an individual's own standards and can have a negative impact on their wellbeing (Baumeister, Stillwell, & Heatherton, 1994). Negative sentiment related to panic buying during a crisis may paint stockpilers as the culprits, which may result in a feeling of guilt. Hence, we posit:

H_6: Panic buying has a significant positive effect on the buyer's post-purchase guilt.

2.6 The moderating effect of retailer interventions

When faced with stockpiling and panic buying, retailers are compelled to take action to mitigate the likely consequences. These measures can be referred to as retailer interventions. Business practice may moderate the impact of contextual and personal factors on panic buying via their influence on the supply in the market (Shou, Xiong, & Shen, 2011; Tsao, Raj, & Yu, 2019; Zheng, Shou, & Yang, 2020). Previous research has proposed that retailers can mitigate the consequences of panic buying by accepting the substitution of products, considering the expected marginal revenue of holding inventory for the supply disruption, and the holding cost (Tsao, Ra & Yu, 2020). If businesses increase the price of products during a crisis or fail to restock, this can also be treated as a signal of scarcity (Stock & Balachander, 2005), which further fuels panic buying. Customers' stockpiling of toilet paper and other necessities in Australia prompted supermarkets to limit the number of items a customer could buy, restrict store opening hours, and adjust return policies (Kelly, 2020). This strengthened the sense of resource scarcity and uncertainty which prompted customers to rely more on situational factors such as government measures, media communication, and peer behaviour to make purchase decisions and triggered the fear of missing out. The effect of these factors on panic buying are stronger where retailers change their retail approaches. In

this regard, stockpiling is likely to be considered a coping strategy for the anticipated shortage (Shah et al., 2015). The above discussion leads us to the following prediction:

H_7: Retailer interventions have a significant respective moderating effect on the relationship between (a) government measures, (b) social media (c) peer influence, (d) FOMO, and panic buying.

Moreover, it is expected that retailer interventions can have an impact on the relationship between panic buying and psychological outcomes, including the feeling of security and guilt. Changes to retail policy is often meant to improve the balance of supply and demand to address market disruptions (Tsao, Raj, & Yu, 2019). Retail measures during a pandemic such as dedicated community hours for essential workers and the elderly aimed to protect vulnerable groups (Sakkal, 2020). These efforts may increase certainty in relation to the current situation and reduce the impact of panic buying on the feeling of security. Furthermore, guilt, another psychological outcome of panic buying, is an internalised conscience and can be triggered by self-conceptions over the evaluative implications of inherent factors (Tangney et al., 1996). In other words, individuals' negative evaluation of their own behaviour ("What I did was terrible") provokes the feeling of guilt (Vess et al., 2014). While panic buying behaviour is an internal cause of guilt, retailer interventions are considered an external influence. When individuals perceive higher levels of retailer intervention, they are more likely to attribute their behaviour to external experiences. This will reduce the impact of panic buying on guilt. Hence, we propose:

H_8: The retailer's intervention has a significant respective moderation effect on the relationship between panic buying and (a) security, or (b) guilt.

3. Methodology

An online survey was conducted to test the research hypotheses. Amazon Mechanical Turk (Mturk) was used to distribute the questionnaire as it is considered a cost-effective and reliable data source for marketing research (Buhrmester et al. 2011; Kees et al. 2017; Smith et al. 2016; Sugathan, & Ranjan, 2019). To ensure the quality of the data and address the ethical issues with MTurk (Haug, 2018; Kan & Drummey, 2018), we adopted quality assurance measures (i.e., attention checks, speeding traps) and compensated the MTurk respondents fairly based on an estimate of the average time that would take them to complete the study. Convenience sampling was used. The research targeted residents aged over 18 in the United States and Australia as panic buying was most noted in these two countries (ANZ,

2020; 9News, 2020; Smith, and Klemm, 2020). A recent study of consumer behaviour during the COVID-19 pandemic found that the pattern of panic buying was consistent across the United States and Australia (Du et al. 2020). The data was collected in April 2020. A total of 503 responses were received. After deleting the outliers and those with missing data, 431 remained for further analysis. The majority of respondents were from the US (i.e. 381 respondents) as MTurk is predominantly more popular among US residents (Robinson et al. 2019). Table 1 depicts respondent profiles. Overall, the distribution of the demographics for both samples were similar except there was no respondents of Hispanic or Latino ethnicity in the Australian sample. We examined buying behaviour related to three products: toilet paper, sanitisers, and food staples including pasta and rice as they were the most commonly stockpiled items during the COVID-19 pandemic.

Insert Table 1 here

As there was no readily available scale to measure panic buying, consistent with the conceptualisation of panic buying in extant literature (e.g. Ding, 2009; Mawson, 2005; Tsao, Raj, & Yu, 2019), we proposed that panic buying manifests in the excessive quantity and unusual frequency of purchase. During the COVID-19 pandemic, hoarding was observed in purchases of sanitisers and essential items such as staples (ANZ, 2020). Toilet paper was also one of the most frequently stockpiled items during this time (9News, 2020; Smith & Klemm, 2020). As panic buying behaviour may vary between products, the respondents were asked about their specific purchase behaviour in relation to sanitisers, staples, and toilet paper. Government measures referred to public health risk mitigation including lockdowns and social distancing. Retailer interventions were reflected in purchase limits, price changes, and return policies. Media influence included social and news media. Peer influence included family, friends, and other shoppers. FOMO was measured by a single indicator which has been proven to show good concurrent validity, construct validity, and test-retest reliability and is adequate for use in research (Riordan et al., 2018). Security was measured by feelings of security for oneself and one's family, while guilt was reflected by the feeling of guilt, regret, and shame. The survey was administered in English. The measurement items are provided in Appendix 1. Income, gender, age, and education were included as control variables.

Common method bias was addressed by following the recommendations by Podsakoff et al. (2003). First, we ensured the anonymity and confidentiality of the respondents. Second, the questionnaire was pilot tested. We removed ambiguous and difficult questions to enhance the clarity of the items and minimise confusion. Reverse coding was

applied to some items to check the consistency. Finally, statistical remedies after data collection were also undertaken to assess possible common method errors including Harman's single factor test, partial correlation procedures, and controlling for the effects of an unmeasured latent methods factors. These procedures generated acceptable results.

4. Analysis and results

4.1 Model estimation

The conceptual framework was tested using three models for toilet paper, sanitisers, and staples. The partial least squares approach to structural equation modelling (PLS-SEM) was employed to validate the model as the model includes both reflective and formative constructs (Hair et al., 2019; Hwang et al., 2020). PLS-SEM has been commonly used by researchers and offers advantages when establishing cause-and-effect relationships and estimating a prediction-oriented model (Herath & Rao, 2009; Simkin & McLeod, 2010). Our analysis used SmartPLS 3.2.9 software to estimate the model parameters (Sarstedt & Cheah, 2019). In line with Hair et al.'s (2018) recommendation, the analysis was carried out based on a two-stage approach: (1) assessment of the reflective and formative measurement model, and (2) assessment of the structural model.

Common method bias was assessed using a full collinearity approach, as recommended by Kock and Lynn (2012). The full collinearity assessment yielded a variance inflection factor (VIF) of between 1.349 and 3.025 (in the toilet paper model), 1.411 and 3.151 (in the sanitiser model), and 1.349 and 2.734 (in the staples model). This was less than the threshold of 3.3 (Kock & Lynn, 2012), when a dummy variable was introduced to the model as one single criterion where all latent variables in the model were included. This indicated that common method bias was not present in the study.

4.2 Assessment of measurement model

4.2.1 Reflective measurement model

Consistent with Coltman et al.'s (2018) definition of reflective constructs that a change in a variable reflects the change in its corresponding measurement item indicating causality flows from the latent construct to the indicator, where panic buying, security, and guilt are deemed to be reflective variables in this study. The assessment of reflective models is provided in Table 2. The composite reliability scores for all reflectively identified variables were greater than .8, indicating high internal consistency (Hair et al., 2016). The average

variances extracted estimates (AVE) were above the cut-off value of .5, demonstrating sufficient convergent validity, and all standardised indicator loadings were higher than .7, indicating satisfactory indicator validity. All AVEs were larger than the respective squared correlations, meeting the Fornelle-Larcker criterion of discriminant validity (Fornell & Larcker, 1981). The HTMT values were below .90, demonstrating discriminant validity (Henseler, Ringle & Sarstedt, 2015).

Insert Table 2 here

4.2.2 Formative measurement model

In our model, government, media, and peer influence, and retail interventions are formative constructs which indicate the causality flow from the indicator to the latent construct with variations in the measurement items causing variation in the construct (Coltman et al. 2008). All VIF values of the measurement items were below 5, indicating that multicollinearity issues were absent (Hair et al., 2016). In addition, the nonparametric bootstrapping procedure (5,000 bootstrapping samples at 95% confidence level) (Tenenhaus et al., 2005) was used. All the factor loadings of formative measurement items for government, media, and peer influence and retail interventions were significant for toilet paper ($p < .05$), while some of the insignificant items with low weights ($p > .05$) for media influence (i.e. social media item for both sanitisers and staples) and retail intervention (i.e. price and return policy in the case of sanitisers, and opening hours and return policies in the case of a staple) were removed. The assessment of the formative measurement model is provided in Table 3.

4.3 Assessment of the structural model

To test the hypotheses, the structural model was analysed by using the bootstrapping technique with 5,000 subsamples. Table 4 depicts the results of the hypotheses testing and Table 5 shows coefficients of determination and Stone–Geisser Q^2. The effects of control variables on panic buying were insignificant.

In relation to toilet paper purchase, the findings confirm the effects of government ($\beta = .171$; $p < .01$), media influence ($\beta = .238$; $p < .001$), peer influence ($\beta = .184$; $p < .05$) on panic buying, and panic buying on the feeling of security ($\beta = .393$; $p < .001$) and guilt ($\beta = .250$; p-value < .01) were significant. Additionally, to evaluate the quality of the structural model, the coefficients of determination (R^2), effect size ($f2$), and predictive relevance (Q^2) were reported. Overall, the model exhibits good explanatory capacity, explaining 28.2% variance in panic buying, 15.4% in the feeling of security, and 6.2% in guilt. The effect sizes

of panic buying on feeling of security (f^2 = .186) and guilt (f^2 = .070) were significant. The predictive relevance was evaluated using the Stone–Geisser Q^2 (Geisser, 1974; Stone, 1974). The Q^2 values for guilt (Q^2 = .049), panic buying (Q^2 = .243), and security (Q^2 = .137) were greater than 0, indicating the model's predictive relevance (Sharma et al., 2019). In addition, the standardised root mean square residual (SRMR) value was less than .08 (SRMR = .034), indicating a good fit (Hu and Bentler, 1999).

In relation to sanitiser purchase, the findings confirm the effects of government (β = .351; p < .001) and news media influence (β = .163; p < .05) on panic buying, and panic buying on the feeling of security (β = .375; p < .001) and guilt (β = .150; p < .01) were significant. The model explained 28.5% in panic buying, 14.1% in the feeling of security, and only 2.2 % of the variance in guilt. The effect sizes of government on panic buying (f^2 = .092) and panic buying on security (f^2 = .168) were significant. The Q^2 values for guilt (Q^2 = .017), panic buying (Q^2 = .248), and security (Q^2 = .125) were greater than 0, indicating the model's predictive relevance (Sharma et al., 2019). In addition, the SRMR value was less than .08 (SRMR = .045), signifying a good fit (Hu and Bentler, 1999)

In relation to staple purchases, the findings confirmed the effects of government (β = .466; p < .001), and news media influence (β = .174; p < .05) on panic buying, and panic buying on the feeling of security (β = .305; p < .001) were significant. The model exhibits good explanatory capacity, as the model explained 27.2% in panic buying, 9.3% in the feeling of security, and only .9% of the variance in guilt. The effect sizes of government (f^2 = .176) on panic buying and panic buying on security (f^2 = .106) were significant. The Q^2 values for guilt (Q^2 = .005), panic buying (Q^2 = .250), and security (Q^2 = .081) were greater than 0, indicating the model's predictive relevance (Sharma et al., 2019). In addition, the SRMR value was less than .08 (SRMR = .066), demonstrating a good fit (Hu and Bentler, 1999)

Therefore, H1, H2, H3, H5, and H6 were somewhat supported whereas H4 was not supported in all three types of purchases.

Insert Tables 4 and 5 here

4.5 Assessment of moderation effect

In order to assess the moderating effect of the retail intervention, the interaction terms between the predicting variables and the moderator were created using a two-stage approach (Becker et al., 2018; Henseler & Fassott, 2010). Only the effects of the interaction terms between government influence and retail interventions on panic buying in the case of toilet

paper ($\beta = .141$, $p < .05$), between panic buying and retail interventions on guilt in the case of sanitisers ($\beta = -.117$, $p < .001$), and between media communication and retail interventions on panic buying in the case of the staple ($\beta = .175$, $p < .01$) were significant (see Table 6). Hence, H7a, H7b and H8b were partially supported. To elaborate on the significant moderation effects, the interaction plots are provided in Figures 1, 2, and 3. Overall, the results demonstrated that when retail intervention is high, the effects of government measures (in the case of toilet paper) and media communications (in the case of a staple) on panic buying were stronger. In the case of sanitisers, when retail intervention was low, the more that customers engage in panic buying, the more they experience a feeling of guilt, and when the retail intervention was high, panic buying had a negative effect on guilt.

Insert Table 6 here and Figures 1, 2 and 3 here

5. Discussion

Drawing on the theory of resource scarcity, crowd psychology, and the theory of contagion, the study examined the antecedents and consequences of panic buying. The results show that the proposed antecedents, namely, government, media, and peer influence were significantly related to panic buying, which in turn had a significant influence on panic buyers' psychological outcomes including a sense of security and guilt. The moderating effects of the retail intervention varied across the different product categories. A detailed discussion of these findings are as follows.

5.1 Government measures and panic buying

The study found that the public health risk mitigation measures undertaken by the government were significantly related to panic buying across all product categories. The measures, inter alia, lockdowns and social distancing were intended to control the spread of the COVID-19 virus. However, the pubic also perceived these preventive measures as a cue for resource scarcity. Despite the different types of lockdown (e.g. staged lockdown, national lockdown), these measures eventually allow citizens to conduct essential services (e.g. food stores, medical shops, hospitals). All hospitality services (restaurants, pubs, and other entertainment venues) and tourism destinations were closed. Lockdowns also included restricted travel and advocated for all to stay at home. Household consumption was therefore expected to increase, accounting for some of the excessive purchases of essential items. The lockdown also resulted in job losses or required non-essential staff to work from home, which would prompt additional food purchases and other necessities. The fear of shortages elicits stockpiling or panic buying. In addition, national and international lockdowns have

implications for the disruption of supply chains, which can also trigger panic buying. These finding is consistent with that of Hobbs (2020).

Social distancing measures intended to encourage maintaining a physical distance between one another in public areas (e.g. sports, parks). Social distance was practised in essential stores where consumers were required to line up at the required distance. Stores were required to close some checkouts to ensure minimum physical distances and may have prompted consumers to buy in bulk to avoid long queues caused by social distancing rules. Customers' excessive purchases within a short period may cause immediate shortages as the retailers are unable to restock due to a lack of time and the lack of available supply. This may enhance the perception of resource scarcity and result in panic buying. This was consistent with O'Brien, Moore and McNicholas' (2020) findings.

5.2 Media influence and panic buying

Customers can receive information from both official news outlets and social media. The study found that social media was significant across all selected panic buying items, nevertheless, the beta coefficient in the case of toilet paper was much higher than the other two. This could be explained by the fact that in contrast to sanitisers and staples which were typically hoarded during a crisis such as a natural disaster or an outbreak, toilet paper stood out as the unexpected phenomenon. The finding demonstrated "following the crowd" behaviours fuelled by online content such as photos of crowds in supermarket isles and empty toilet paper shelves (Moran, 2020).

News coverage relating to COVID-19 dominates TV channels, online and offline news outlets, and as a consequence, played an important role in the purchase of the products examined in this study. The frequency and intensity of this coverage can cause uncertainty. These posts are part of the social learning process. Consumers intuitively react to this by stocking up essential items. Past experience with natural disasters and other pandemics or epidemics were drivers to ensure the fulfilment of basic needs and survival by engaging in the stockpiling and hoarding essential items (food and medication). This finding concurs with Cheng (2004) and Ding (2009) which examined customer behaviour during the 2002-2004 SARS outbreak.

5.3 Peer and FOMO influence and panic buying

FOMO was not a significant determinant of panic buying behaviour whereas peer influence was found to be significantly related to panic buying in the case of toilet paper.

Compared to sanitisers and staples (such as bread and milk), toilet paper was less likely to be considered an immediate necessity of an impending health crises (Andrew, 2020). The study found that peer influence played a more significant role in the stockpiling of products that were perceived to be less essential. In other words, consumers were more motivated to engage in panic buying by observing what others do.

This finding conforms to the theory of contagion which suggests consumers tend to mimic others (Bavelas, Black, Lemery, & Mullett, 1987). As COVID-19 has been an unprecedented pandemic, its consequences remain uncertain. Those who have not experienced similar crises tend to react based on the behaviours of their peers and friends as a social norm. It is also the case that consumers who are not sure how to react will go with the flow and mimic others. It may also be understandable that observing other consumers stocking up on products from the shelves in the supermarket, one may intuitively follow suit. These findings concur with those in Cheng (2004), Roy et al. (2020), and Zheng, Shou, and Yang (2020).

5.4 Panic buying and consequences

Panic buying involves stockpiling products with the intention for one's own supply to last for an extended period depending on the perceived severity of the crisis and level of uncertainty. Whilst this behaviour may be construed as irrational, the findings of this study shows that panic buying resulted in a sense of security. This result is plausible on account of the nature of the COVID-19 pandemic. The speed and scale of transmission of the virus resulted in millions of infections and thousands of deaths and continues to have a negative impact at the macro, meso, and micro levels. National economies have stagnated, and industry and business suffer significant financial loss. Individuals are experiencing job losses or unexpected career changes and challenges and global vaccination remains a distant reality. This status quo likely prompts consumers to stockpile as a means to combat the uncertainty and in some way secure the family at least in regard to essential needs.

The study also shows that panic buying was significantly related to buyers' guilt, especially in the case of toilet paper and sanitisers. As the effect of toilet paper panic buying on guilt was most significant among the three types of products. This finding suggests that panic buying of less essential items is more likely to lead to a feeling of guilt. In fact, impulsive buying often results in guilt as demonstrated by Yi and Baumgartner (2011) and Miao (2011). Stockpiling has a significant impact on vulnerable shoppers such as the elderly

and those with disabilities. Governments and businesses have urged consumers to be considerate (Kelly, 2020), leading to a greater sense of guilt for stockpilers'.

5.5 Moderation of retailer interventions

In response to shopper panic buying, retailers-imposed limits and restrictions on the purchase of essential items to moderate stockpiling behaviours. For example, in Australia retailer interventions included essential products (e.g. staples, face masks, and hand sanitisers) being limited to two items per purchase, increasing the price, and by providing dedicated shopping hours for health workers and consumers with disabilities (9News, 2020). However, the study found that retailer interventions only had a significant moderation effect on the relationship between government measures and the stockpiling of toilet paper, and between media communications and staples purchase.

The findings indicated that retail interventions interacted with government measures to influence toilet paper purchase. The pandemic has been noted for the panic buying of toilet paper (e.g. the USA, Australia, and the UK). Retailers attempted to reduce hoarding behaviour by limiting purchase quantities. The findings suggest that such interventions strengthened panic buying via government influence, counter to the retailer's intention. It suggests that the limits imposed by the retailers may imply a foreseeable shortage of the product, especially when government intervention measures intensified with the pandemics spread. For instance, supermarkets in Australia implemented the quantity limit to one transaction at the same store (Kelly, 2020). This measure was unable to stop consumers from re-entering the store or travelling to other retailers or supermarkets. A similar finding was reported in Shah et al. (2015). Furthermore, the level of retail intervention strengthens the impact of media communication on staples purchase. As staples such as bread and milk are daily essentials, customers are more likely to rely on widespread observations on news media to decide their purchases.

Retailer interventions might help reduce panic buyers' guilt, where consumers attempt to stockpile, the control measures implemented by the supermarket may be a signal for consumers to rationalise their panic purchase by attributing their irrational behaviour to the retail intervention (Vess et al. 2014). As guilt is an internalised conscience (Tangney et al., 1996), a high level of external attribution may reduce the impact of panic buying on guilt and vice versa.

6. Implications

The current study examined the antecedents and consequences of panic buying that occurred during the COVID-19 pandemic from a combination of theoretical perspectives. The resource scarcity principle was utilised to understand the impact of government pandemic interventions on consumer panic buying behaviours. Crowd psychology explained social media influence on panic buying, and the theory of contagion accounted for peer effect. The findings highlighted theoretical contributions to the literature and have practical implications for the practitioners and authorities as follows.

6.1 Theoretical implications

This study contributes to consumer behaviour research by integrating public policy, economy theory (resource scarcity), and consumer psychology within the marketing literature. Government measures manifested as public health risk mitigation regulation that intended to combat a sustained health crisis. However, the significant impact on consumer behaviour indicates that public policy research must embrace both intended (e.g. managing the spread of the outbreak) and unintended consequences (e.g. panic buying). The theory of scarcity explains the unintended adverse effect which can be construed as the spill-over effect. This finding cautions public policy researchers to take a holistic perspective. Although social learning theory may describe the influence of the media, the phenomenon of panic buying is more likely to be a symptom of crowd psychology. Such behaviour is a result of using social proof heuristics and following the crowd, facilitated by media communication. This finding integrates developmental and crowd psychology theories to understand consumer behaviours and provides a fresh perspective on consumer research. The theory of contagion is generally used to explain the mimicking of emotional displays and behavioural patterns of the crowd. This study extends its application to consumer research to understand individual consumer behaviour.

6.2 Practical implications

The study also has practical implications for policymakers, social media communities, marketers, and consumers. The findings show that the government and policymakers must be aware of the adverse spillover effects of their policies and interventions when combating a health crisis. Whilst focusing on the effectiveness of managing issues relating to the pandemic, contingency plans must be in place to minimise the unfavourable effects. As

consumers tend to be affected by news and conversations within social media platforms, authorities must monitor fake news and the appropriateness of posts in order to prevent undesirable crowd behaviour.

Stockpiling may bring instant benefits for retailers and manufacturers but there are also short and long-term negative consequences. In the short run, a stockout can result in customer dissatisfaction, staff shortages, and disruption to supply chain management. Stockpiling also affects long-term forecasts and planning for marketers. Marketers must develop appropriate strategies to counter panic buying. However, some retail interventions may affect panic buying as a result of government measures and media communications, marketers must look into the effectiveness of these interventions. Finally, stockpiling may provide a sense of ontological security for oneself and one's family, but it may also provoke guilt. As guilt affects individual mental health (Bybee and Quiles, 1998), consumers must moderate stockpiling behaviour to minimise the negative consequences of mental health.

7. Limitations and future research

Although this study took an integrative approach to examine the antecedents and consequences of panic buying, some limitations must be acknowledged. First, the current study was cross-sectional, it is cautionary to claim causal effects between the proposed antecedents and outcomes. Second, the outcome variables opted for this study were limited to personal consequences. Third, whilst retailer interventions may have a significant moderation effect, the buyer's individual characteristics such as personality traits as well as product categories may also play a role in panic buying behaviour. Fourth, the study was conducted in the USA and Australia with significantly different sample sizes. The findings might be more reflective of the phenomena in Australia, so the implications of this study must be cautioned.

To address the limitations of this study, some suggestions are offered for future research. Firstly, a longitudinal study or a follow-up study should be conducted to understand the causal effects between the proposed independent variables and outcomes since the pandemic is ongoing. Secondly, the antecedents that affect consumer behaviours in the context of a sustained health crisis, such as COVID-19, may vary across regions and cultures, a broader range of factors and other mediating mechanisms such as the emotions associated with the appraisal of external factors could be explored to better understand the causes and effects of irrational buying behaviours (e.g. panic buying). Similarly, the outcome variables could be extended to embrace the consequences for the retailers and other relevant

stakeholders. Finally, given that some countries reported less or no panic buying, culture may exert some effect on this phenomenon. Hence, a comparative, cross-national study could be conducted to provide a more holistic picture and greater insight into panic buying.

8. Conclusions

The study drew upon resource scarcity principle, crowd psychology, and the theory of contagion to examine the antecedents and consequences of panic buying during the COVID-19 pandemic. The opted antecedents included government preventive measures for controlling the spread of the pandemic and the influence of social media and peers. Personal consequences were opted as outcome variables. Retailer interventions was modelled as a moderator. Panic buying was assessed on purchase frequency and quantity of the selected stockpiled items (i.e. toilet paper, sanitisers, and staples). The study was undertaken in the USA and Australia as panic buying was most reported in these two countries. The results confirmed that preventive measures and social media were significantly related to panic buying which influenced purchasers' sense of security and guilt. Retailers could only impact on consumers' irrational purchase under the influence of the government's preventative measures. The theoretical contribution of this research manifests primarily in integration of public policy, economic theory, and consumer psychology to understand consumer behaviours and public health (e.g. wellbeing). This is the first study to address the unintended spillover effect of public policy under these conditions. The findings have important practical implications for policy makers, retailers, and the public. Policy makers must be prepared to address the unintended consequences of pandemic health regulation. Retailers should reassess their intervention measures undertaken to prevent stockpiling and panic buying since the moderating effect was minimal. Given the undesirable personal consequences resulting from panic buying, the public should manage their irrational purchases to minimise regret and guilt.

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Table 1: The respondents' profiles

Variables		US	Australia
Gender			
	Male	54.3	49.0
	Female	45.2	51.0
Education			
	High school	8.1	7.8
	Some college	18.4	15.7
	Bachelor's degree	56.4	58.8
	Postgraduate	17.1	17.6
Age	18-25	6.0	-
	26-35	40.9	47.1
	36-45	21.5	31.4
	46-55	20.7	13.7
	56 or more	10.8	7.8
Ethnicity	Caucasian	70.1	52.9
	Asian	10.0	31.4
	Hispanic or Latino	9.2	-
	African	7.9	3.9
	Arabian	.3	5.9
	Other	2.6	5.9
Marital status	Single	35.4	51.0
	Married without children	16.8	17.6
	Married with children	45.1	17.6
	Other	2.6	13.7
Annual income (US dollars)	Less than 20,000	14.5	15.7
	20,000 - 39,999	22.6	23.6
	40,000 - 59,999	26.5	19.6
	60,000 - 79,999	17.8	21.6
	80,000 - 99,999	10.2	9.8
	100,000 and above	8.4	9.8

Table 2: Assessment of the reflective measurements

Variable	Composite Reliability			Average Variance Extracted			Factor loading			Max. squared correlation			HTMT		
	Paper	Sanitisers	Staple	Toilet paper	Sanitisers	Staple	Paper	Sanitisers	Staple	Paper	Sanitisers	Staple	Paper	Sanitisers	Staple
Panic buying	.951	.959	.961	.916	.961	.924	.954	.959	.961	.154	.140	.092	.434	.412	.333
Security	.946	.951	,898	.856	.951	.907	.950	.950	.951	.154	.140	.093	.434	.412	.337
Guilt	.947	.947	,916	.907	.947	.856	.908	.909	.909	.093	.093	.093	.337	.337	.337

Note: HTMT= Max. heterotrait-monotrait ratio of correlations. Paper= toilet paper

Table 3: Assessment of formative measurements

	Toilet paper				***Sanitisers***				***Staple***			
	Beta	SD	T	P	Beta	SD	T	P	Beta	SD	T	P
Government												
Lockdown	.771	.108	7.167	***	.723	.101	7.133	***	.547	.106	5.181	***
Social Distancing	.337	.135	2.491	*	.353	.114	3.1	**	.567	.104	5.46	***
Media Influence												
News	.612	.129	4.735	***	.886	.134	6.471	***	.854	.145	5.906	***
Social media	.473	.136	3.485	***	.168	.160	1.051	+	.191	.176	1.085	+
Peer Influence												
Family and Friends	.514	.112	4.595	***	.768	.120	6.399	***	.583	.177	3.297	**
Other Shoppers	.603	.107	5.655	***	.302	.142	2.124	*	.520	.179	2.899	**
Retail Intervention												
Opening Hours	.442	.035	12.682	***	.604	.242	2.498	*	.401	.395	1.014	+
Price	.368	.040	9.159	***	.434	.224	1.938	+	.739	.347	2.132	*
Return policy	.353	.037	9.641	***	.059	.279	.211	+	-.055	.423	.127	+

Table 4: Hypothesis testing

	β	t-Statistics	p-values	f^2	β	t-Statistics	p-values	f^2	β	t-Statistics	p-values	f^2
H1: Government measures → Panic buying	.171	2.737	**	$.027^{+}$	.351	5.453	***	$.092^{**}$	.466	8.094	***	$.168^{**}$
H2: Media influence → Panic buying	.238	3.004	**	$.030^{+}$	.163	1.984	*	$.018^{+}$	.174	2.259	*	$.018^{+}$
H3: Peer influence → Panic buying	.184	2.447	*	$.021^{+}$	.051	.539	+	$.005^{+}$	-.113	1.578	+	$.008^{+}$
H4: FOMO → Panic buying	.013	.240	+	$.003^{+}$	.034	.540	+	$.004^{+}$	.015	.352	+	$.003^{+}$
H5: Panic buying → Security	.393	9.952	***	$.186^{***}$	.375	8.627	***	$.168^{**}$*	.305	6.799	***	$.106^{**}$
H6: Panic buying → Guilt	.250	5.608	***	$.070^{**}$	.150	3.381	**	.025	.094	1.744	+	$.012^{+}$

Notes: **p < .001, *p < .05; $^{+}$ > .05

Table 5: Coefficients of determination and Stone–Geisser Q^2

	Toilet paper		**Sanitisers**		**Staple**	
	R^2	Q^2	R^2	Q^2	R^2	Q^2
Panic buying	.282	.244	.285	.248	.272	.243
Security	.154	.137	.141	.125	.093	.081
Guilt	.062	.049	.022	.017	.009	.005

Table 6: Assessment of moderation effects

IVs	DVs	Toilet paper		Sanitisers		Staple	
		β	p	β	p	β	p
Retail intervention	Panic buying	-.028	+	-.068	+	-.201	**
Retail intervention	Security	.340	***	.332	***	.326	***
Retail intervention	Guilt	.661	***	.614	***	.557	***
Government measures*Retail intervention	Panic buying	.141	*	.040	+	.005	+
Social media*Retail intervention	Panic buying	-.084	+	-.064	+	.175	**
Peer influence*Retail intervention	Panic buying	-.016	+	.046	+	-.072	+
FOMO*Retail intervention	Panic buying	-.006	+	.068	+	.080	+
Panic buying*Retail intervention	Security	-.034	+	-.081	+	-.015	+
Panic buying*Retail intervention	Guilt	-.043	+	-.117	**	-.003	+

Notes: **p < .001, *p < .05; + > .05

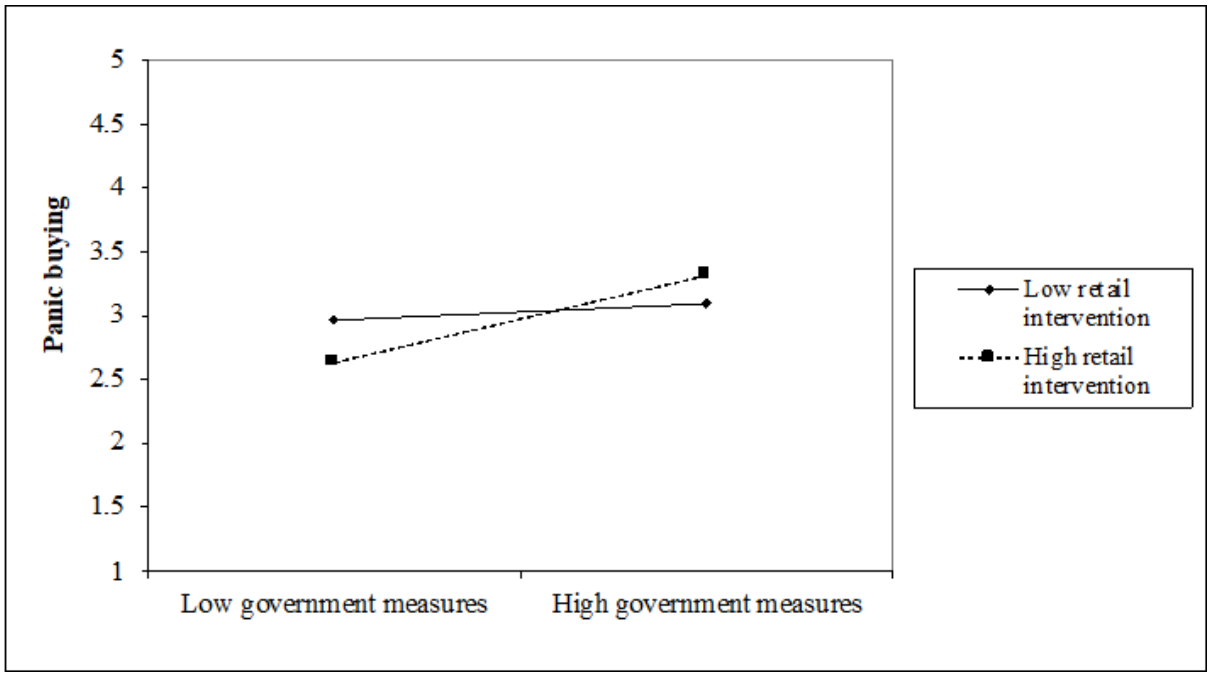

Figure 1: Moderating effect of the retailer's intervention on the relationship between government measures and panic buying in the case of toilet paper

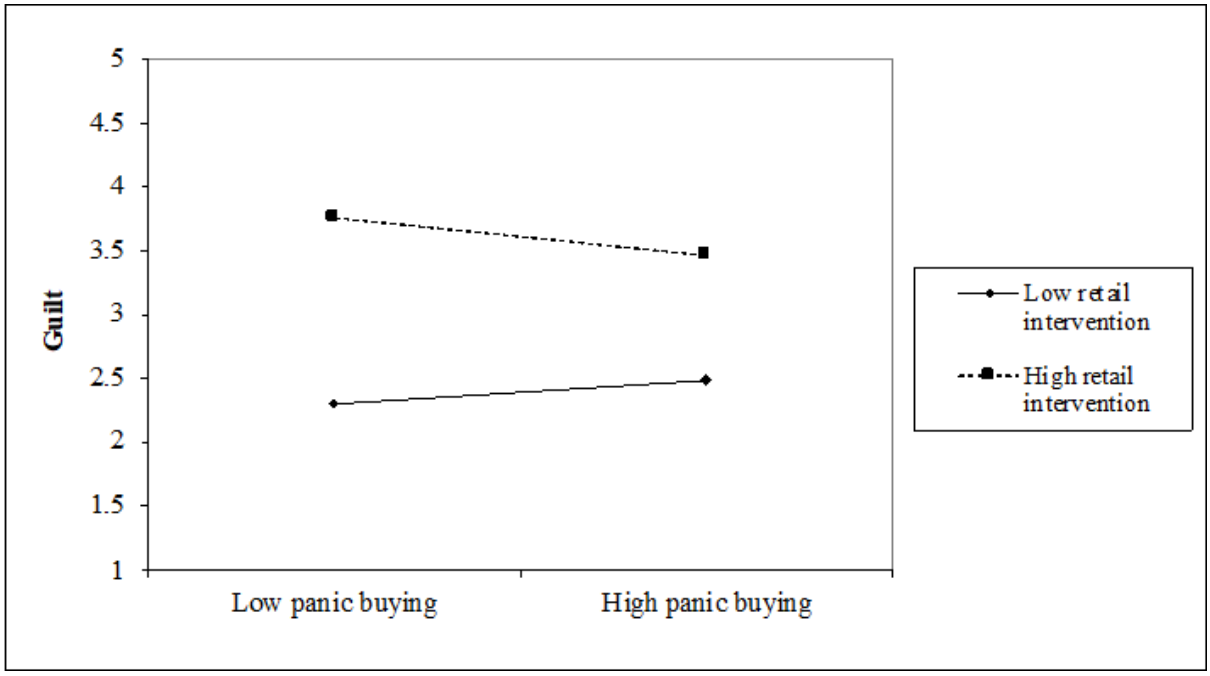

Figure 2: Moderating effect of the retailer's intervention on the relationship between guilt and panic buying in the case of sanitisers

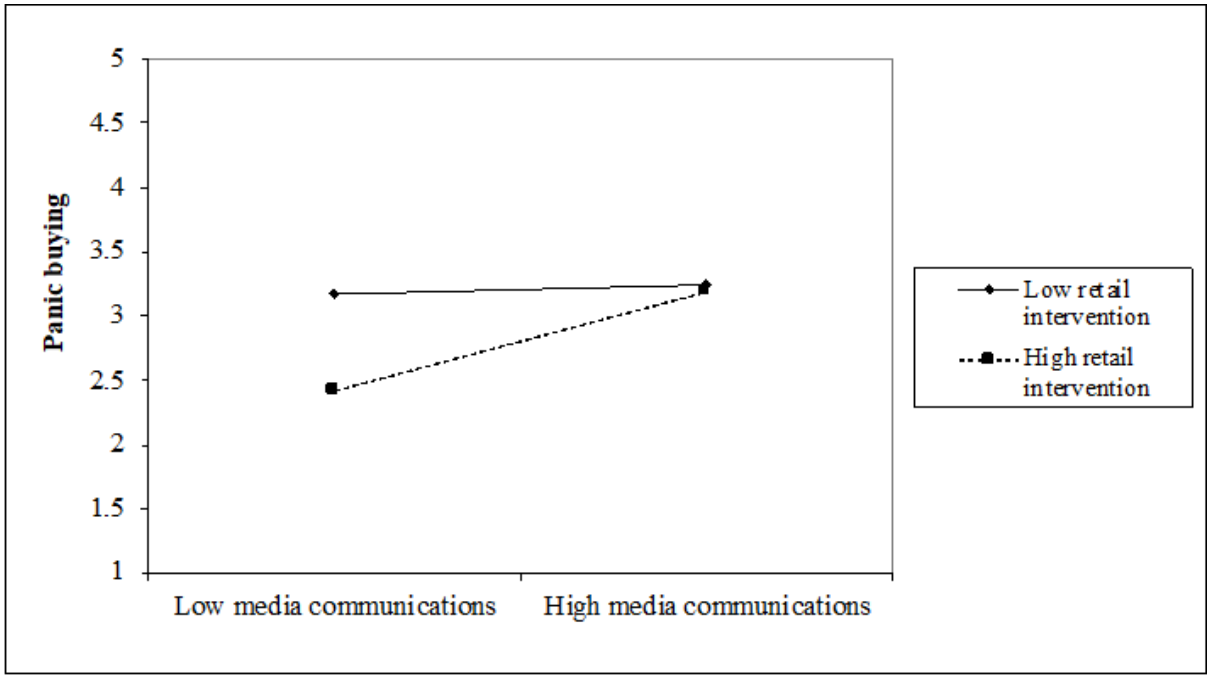

Figure 3: Moderating effect of the retailer's intervention on the relationship between media communications and panic buying in the case of staple