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Social determinants of panic buying behaviour amidst COVID-19 pandemic: The role of perceived scarcity and anticipated regret

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ABSTRACT

Panic buying behaviour is inherently undesirable due to its detrimental impact on community’s resources and disruptions to supply chain systems. The prevailing COVID-19 pandemic has seen a resurgence of this phenomenon across the world, leaving supermarkets in stockout situations. While panic buying is largely reasoned as a psychological reaction to an extreme event, it is also a socially relevant behaviour as our perception of a crisis can be shaped by our observations and interactions within the society. The social determinants of panic buying behaviour, particularly on how these factors heighten one’s perception of scarcity, and trigger panic buying behaviour, are studied. A theoretical model is developed to explain panic buying behaviour in a social context by synthesizing various social and behavioural theories, and the inter-relationship among the latent constructs is analysed using the structural equation modelling approach. Accordingly, an online survey was administered and analysis of the data confirmed that non-coercive social influence, social norm and observational learning directly influence one’s perception of scarcity. Additionally, perceived scarcity can motivate panic buying behaviour directly or indirectly through feelings of anticipated regret. This study has contributed to the limited literature on panic buying. Understanding the underlying mechanisms of panic buying will aid policymakers and businesses in developing intervention or support strategies to cope with such behaviour.

1. Introduction

An individual’s shopping behaviour is dynamic and largely influenced by four main types of factors – cultural, social, personal and psychological (Rani, 2014). These factors help to identify the buying patterns or trends of everyday consumers. The consumer behaviour, however, could change in response to an unpredictable crisis event. One commonly observed behavioural response is panic buying (PB), which is the action of “buying large quantities of a particular product or commodity due to sudden fears of a forthcoming shortage or price rise” (Lexico, 2020).

PB is not a new phenomenon and has been observed in numerous historical events. PB behaviour, however, is highly undesirable as it is detrimental to a community’s resources and supply chain systems (Arafat et al., 2020a). Many countries experienced food shortages and rationing during the first and second World Wars, while Americans emptied supermarket shelves during the Cuban Missile Crisis in 1962 as well. The most severe disease outbreak in history was the 1918 flu pandemic, affecting approximately one-third of the world’s population (Centres for Disease Control and Prevention, 2019). This plague triggered hoarding of remedial medication such as Quinine and Vick’s Vapour Rub (Freckelton Qc, 2020).

Today, the prevailing Coronavirus (COVID-19) pandemic bears uncanny resemblance to the 1918 flu, being a respiratory disease that has affected millions so far on a global scale. It was officially declared as a global health emergency by the World Health Organisation (WHO) on January 30, 2020, and subsequently classified as a pandemic on March 11, 2020. As the situation worsened, countries began implementing city or nationwide lockdowns, and restricting the movement of citizens in order to remediate the spread of the virus. Recently (December 2020), a more serious variant, the UK COVID-19 strain, is rapidly spreading around the globe and this has heightened the pandemic. Especially during the early stage of the COVID-19 pandemic, panic buying behaviour was observed across the world in countries such as Australia, the United States (US), the United Kingdom (UK), Italy, Hong Kong, South Korea and Singapore (The Straits Times, 2020). Many rushed for essential items, leaving local supermarkets with bare shelves. In UK, this behaviour resulted in an increase of £1bn worth of food collectively in

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their homes (Nicola et al., 2020). Apart from that, the surge in demand also caused price increases on essential goods such as rice, which hit a 7-year price high in early 2020 (Tan, 2020).

PB behaviour rarely occurs hence it remains an area of consumer behaviour research that is yet to be sufficiently explored. Herein, a review of available literature with respect to PB generated over two hundred published research papers on Scopus, a third of which were published in 2020 itself. A number of these papers discussed the psychological triggers for PB behaviour, thereby highlighting common constructs such as fear (Jezevskas-Zychowicz et al., 2020), loss of control (Barnes et al., 2020), perceived scarcity, perceived threat (Yuen et al., 2020a) and insecurity (Arafat et al., 2020b), Islam et al. (2020)’s recent discussion examined impulse and obsessive purchasing behaviours across multiple countries using the Stimuli-Organism-Response (SOR) and competitive arousal model. Dammeyer (2020) delved into personality and individual differences, while Lins and Aquino (2020) developed a Panic Buying Scale (PBS) to understand the psychosocial phenomena associated with PB behaviour. On the other hand, several authors focused on the implications of PB behaviour from various viewpoints such as its impact on an individual’s psychological (Mukhtar, 2020) and mental (Idris, 2020) health, on respective sectors of the global economy (Nicola et al., 2020), as well as on its disruption to supply chain systems (Zheng et al., 2020).

From the above review of the literature, an observed research gap is that most research focuses on the psychological determinants which contain cognitive or emotional constructs to explain PB. Very few studies have focused on the determinants of PB from a sociology perspective. Although PB is largely reasoned as a psychological reaction to an extreme event, it is a socially relevant (Arafat et al., 2020c; Wang et al., 2021) behaviour as well. This study draws on social learning theory to support the relevance and importance of PB for being a socially relevant behaviour. Social learning theory proposes that in a social setting, a behaviour is imitated through observation and compliance. Our perception of the intensity and extent of a crisis could be largely influenced through social observations and interactions (Nabavi, 2012). This is especially apt in the current technologically advanced era, where information spreads rapidly. As people begin to observe more of the PB behaviour, they may begin to imitate the behaviour for various reasons such as fear-of-missing-out, anticipated regret, or herd mentality by simply following the majority. Furthermore, widespread PB behaviour may amplify their severity or scarcity perception amidst the outbreak and influence them to engage in PB and inextendently forces retailers or supermarkets into stockout situations.

Given that many past literatures have addressed the psychological aspects of the PB behaviour, this research, therefore, aims to give attention to the social determinants of PB. The present study intends to provide a better understanding on how these social factors influence an individual’s perceived scarcity during a pandemic outbreak. In particular, this study will look into four main social constructs – coercive and non-coercive social influence, observational learning and social norm. As an individual’s perceived scarcity amplifies, it may trigger a sense of anticipated regret, which in turn might motivate an individual to engage in PB behaviour. Moreover, as pandemic outbreaks are highly non-predictable, understanding what leads consumers to panic buy will enable businesses as well as authorities to develop strategies to cope with PB behaviour in future.

The originality of this study lies in its positioning of PB as a social behaviour. This study synthesises and introduces four social constructs which include coercive and non-coercive social influence, observational learning and social norm. Each social construct provides a unique explanation to PB. In addition, aligned with social learning theory which proposes the presence of cognitive factors which serve as mediators between social constructs (i.e., stimuli) and response (i.e. behaviour), this study identifies two important cognitive constructs that could trigger PB. They are perceived scarcity and anticipated regret. In effect, this study extends the existing literature by utilising cognitive and social constructs to explain PB. In addition, this study provides better nomological understanding of the relationships between the constructs by proposing that the social constructs influence the cognitive constructs, which subsequently influence PB.

2. Literature review

In this section, each hypothesis is discussed and supported with reference to the literature. The section first begins by discussing the direct determinants of PB and their relationships, followed by the direct determinants of perceived scarcity. Thereafter, the hypotheses are depicted.

2.1. The determinants of panic buying

2.1.1. The effect of perceived scarcity on panic buying

The central theme to perceived scarcity model is the principle of scarcity. A consumer’s purchase decision is often made contextually, swayed by an individual’s surrounding circumstances. Scarcity was introduced as a fundamental economic problem of having limited resources and theoretically limitless wants (Chappelow, 2019). Subsequently, various studies have observed that scarcity can have a psychological effect on the value of a product as well (Lynn, 1992). Psychologist Timothy Brock (1968) supported this observation through the introduction of the Commodity theory, stating that any commodity will be valued to the extent that it is unavailable (ÇINAR, 2020).

Jack Brehm’s Reactance theory moreover suggests that if one’s freedom to engage in a specific activity or behaviour is threatened, the threatened behaviour becomes more attractive, which in turn motivates the individual to take necessary action to regain that sense of freedom (Lesnne and Venkatesan, 1989). This is relatible to PB behaviour, as when an individual perceives an item to be limited or soon unavailable, he (both genders) may be more motivated to obtain the item (Arafat et al., 2020b; Islam et al., 2021; Omar et al., 2021), so as to ensure freedom of choice. Therefore, the model proposed in this study hypothesises that:

H1. Perceived scarcity positively influences panic buying behaviour

2.1.2. The effect of anticipated regret on panic buying

Next, this study also proposes that perceived scarcity indirectly motivates PB behaviour through feelings of anticipated regret (Kaur and Malik, 2020). Regret is generally identified as a negative emotion that one experiences in contemplation of how the outcome of his present situation could have been better, if he had decided or acted differently (IResearchNet, 2020). While regret is normally experienced in retrospect of a decision, anticipated regret occurs prior to making a choice, when an individual imagines the regret he will probably feel if he makes a particular decision (Somunandaram and Diecidue, 2017; Wong and Kwong, 2007).

Janis and Mann (1977) addressed the psychological aspects of anticipated regret, recognising it as an influencing factor in an individual’s decision-making process. A prominent theory developed in the economic field was the regret theory, formalised by economic theorists Bell (1982) and Loones and Sugden (1982). This theory was introduced in an effort to expand on preceding economic choice theories such as the Expected Utility Theory (Von Neumann and Morgenstern, 1947) and the Minimax Regret Theory (Savage, 1954), which are largely quantitative in nature. Loones and Sugden’s Regret theory assumes that people are subjected to both regret and rejoice emotions, which are taken into account when making decisions under uncertainty. Anticipated regret was further discussed in consumer purchase decisions (Wang et al., 2020). Simonson (1992) established that purchase decisions could be influenced if consumers were to consider the possible decision errors beforehand. The study, however, was conducted in the context of purchase timing and choice of brand (Simonson, 1992).
Zeelenberg (1999) demonstrated a relationship between anticipated regret and decision-making under uncertainties and found that individuals would choose to opt for the regret-minimising option under such circumstances (Krahmer and Stone, 2013). Specifically, the study identified that individuals anticipate regret when the consequences as a result of a particular decision are more salient and quicker to materialise once the decision has been made. Amin et al. (2018) also concluded that consumers are regret averse, finding that feelings of anticipated regret led to increased efforts in a consumer’s behavioural intentions. Given the seriousness and uncertainty of a pandemic outbreak, these assumptions are possibly applicable (Jin et al., 2020). Furthermore, people tend to be more possessive of products which they would not have necessarily needed under scarcity conditions (Byun and Sterngquist, 2008, 2012). Hence, the proposed model hypothesises the following:

H2. Anticipated regret positively influences panic buying behaviour

2.1.3. The effect of perceived scarcity on anticipated regret

Anticipated regret is also said to be linked to perceived scarcity (Yuen et al., 2020a). Kartika (2019) concluded that if consumers perceive that a product is scarce, they will predict the negative emotions they will experience, if they do not purchase the product (Byun and Sterngquist, 2012). Verhallen and Robben (1994) further elaborated that the cause of a product’s limited availability also contributes to a consumer’s preference increase. Therefore, as a consumer’s perceived scarcity intensifies, the scarcity effect can evoke feelings of anticipated regret. Thus, the proposed model hypothesises that:

H3. Perceived scarcity positively influences feelings of anticipated regret

2.2. Social determinants of perceived scarcity

The majority of recent studies offered a scattered view into social constructs that influence PB behaviour. Several papers focused solely on specific social constructs such as exposure to online information (Laato et al., 2020), social media (Naeem, 2021) as well as government intervention (Prentice et al., 2020) and their resulting influence, while others presented several social factors as part of a broader research scope (Bavel et al., 2020; Rani, 2014; Zheng et al., 2020). In order to provide a comprehensive view into the social determinants of PB behaviour, the proposed model therefore focuses on four social constructs as antecedents of perceived scarcity.

2.2.1. The effect of coercive influence on perceived scarcity

Social influence is a general term that describes how an individual’s thoughts, feelings, and actions can be affected by other people (Smith et al., 2011). More often than not, people within communities are embedded in complex webs of reciprocal relationships (Forsyth, 2013), making social influence an inevitable experience. As a result, it has become a fundamental subject in the field of social psychology (Mason et al., 2007) and holds different interpretations and applications (Hausman and Johnston, 2010). With that said, an underlying theme to these studies is that power – the capability to act on or direct an action or course of events – is synonymous with any form of social influence (Levi, 2013). Based on prior historical events, PB behaviour affects communities, businesses as well as governing authorities, the majority of which use a certain level of power in their influence strategies. Therefore, this study takes reference from theories which have defined social influence in such context.

Coercion includes pressuring or prohibiting certain acts to be performed by a person or community through the use of punitive steps (Khan, 2015). Coercive and non-coercive social influences hence divide influence strategies based on the degree of coerciveness associated with the influence (Hausman and Johnston, 2010). Coercive influence utilises source-controlled rewards or punishments such as threats, warnings, and legalistic pleas to motivate compliance (Gelderman et al., 2008). Non-coercive influence looks to change an individual’s attitude through information exchanges and requests and recommendations of others (Hausman and Johnston, 2010).

Coercive social influence has a direct impact on an individual’s perceived scarcity as it supports the Reactance theory, where the presence of warnings or threats limits one’s freedom of choice (Gupta, 2013). Prentice et al. (2020) further concluded that PB appeared to correspond to changes in government interventions and measures in Australia. The proposed model therefore hypothesises that:

H4. Coercive social influence has a direct effect on perceived scarcity

2.2.2. The effect of non-coercive influence on perceived scarcity

Non-coercive influence strategies such as information exchanges and recommendations do affect an individual’s perceived scarcity as well. Present-day technologies allow for much larger and more advanced range of communication channels for information sharing. The convenience of smartphones, tablets or laptops offer instantaneous access, while the power of social media gives free reign as to the type of information published and communicated within these networks. One major implication with this is that it affects the credibility and accuracy of information being circulated (Hormozen and McNnes, 2018). Prevaling channels of information exchange such as mass and social media have the capability to inform and dispel misinformation or insight hysteria through headlines (Ahmad and Murad, 2020; Loxton et al., 2020). An extensive coverage of panic buying through these media outlets further encourages this behaviour (Philip and Cherian, 2020). A large amount of misinformation surfaced on social media networks during the 2013–2016 West Africa Ebola epidemic, raising fear and risk perceptions among the public (Selli et al., 2020). Jezewska-Zychowicz et al. (2020) found that an individual’s perception of having limited access to food is heightened when more trust is placed on information received from the media as well as from other people such as friends or bloggers. This increases one’s tendency to purchase larger amounts of food than usual. Therefore, an individual’s perception of scarcity can be altered according to the type and amount of information that he is exposed to. Another form of non-coercive influence would be increases in prices for everyday items (Tan, 2020), as consumers may perceive price changes as a result of supply and demand imbalance. Hence, the proposed model asserts that:

H5. Non-coercive social influence has a direct effect on perceived scarcity

2.2.3. The effect of social norms on perceived scarcity

Social norms are defined as rules and standards that are understood by members of a group, and/or constrain social behaviour without the force of laws (Cialdini and Trost, 1998). It is a form of influence that operates implicitly (Dempsey et al., 2018) and tends to emerge from cues and signs that are commonly observed during social interactions (Crossman, 2019). Cialdini and Cialdini (1990) classifies social norms into two distinctive types – Descriptive and Injunctive norms. Descriptive norms refer to the popularity of a certain act, while Injunctive norms refer to the social approval of the act (Park et al., 2009). On the other hand, Bicchieri and Xiao (2009) rationalises that an individual complies to a norm depending on either Empirical expectations, which is what we expect others to do or Normative expectations, which is what we believe others think we ought to do (Tesar, 2020). Social norms play an important role in consumer decision-making, as individuals often take into account the expectations and behaviours of others prior to making a decision (Melnyk et al., 2010).

In the context of the COVID-19 pandemic, previous literature have classified social norms as behaviours adopted during this crisis and how social norm compliance such as purchasing of masks or hand sanitisers occurs (Yang et al., 2020). This study, however, regards PB behaviour as an existing socially unacceptable norm. In uneventful situations such as limited disasters and disease outbreaks, it is possible that existing norms...
may break down and be replaced by new, spontaneously emerging norms (Patent, 2020) as a response to a precipitating crisis (Arthur, 2013). This is known as the Emergent Norm theory (Turner and Killian, 1957), which has been commonly applied to disaster research. It has also been suggested in explaining aggressive or selfish behaviours observed during mass panics (Johnson, 1987). Thus, if surrounding people are suddenly accepting and approving of PB behaviour, one could infer that information regarding the limited availability of products could be true or viewed as a response to a crisis, thus heightening their scarcity perception. Therefore, the proposed model asserts that:

**H6.** Social norms have a direct effect on perceived scarcity

### 2.2.4. The effect of observational learning on perceived scarcity

Observational learning is one of four principles under the Social Learning Theory (SLT) (Nabavi, 2012). Developed by Albert Bandura, it theorises how individuals learn through the process of watching others, retaining the information, and then later replicating the behaviours that were observed (Cherry, 2019). This applies to the attitudes and reactions of others as well (McGregor, 2009). An individual learns from three different types of models – behavioural or live, symbolic and verbal (Bandura et al., 1961). Behavioural or live modelling refers to an individual exhibiting a behaviour real time in the presence of the observer. Symbolic modelling are behaviours of prominent people or characters depicted through media sources such as the television, movies or the internet. Verbal modelling is when a behaviour is explained as opposed to being acted out physically (Bajcar and Babel, 2018). For the purposes of this study, observational learning shall refer to those modelled through behavioural or live sources.

SLT breaks down the observational learning process into four stages – Attention, Retention, Reproduction and Motivation (Bandura, 1997). It is not simply a blind imitation of another person’s actions. Instead, an individual tries to identify and internalise any rules or principles contained within these decisions and adapts them to his own future behaviours (Bandura, 2008). Directly observing large-scale panic buying behaviour could increase one’s perception of scarcity as it leads an individual to worry about future product availability in the short-term (Erev et al., 2020). Bandura et al. (1961) further concluded that individuals are also more inclined to replicate a behaviour if the situation is confusing, ambiguous or unclear (Cherry, 2019). Yuen et al. (2020a) reasoned that individuals may imitate the behaviour of those who have acted earlier because they lack outside information as well. Outside information refers to that of which others might possess or have been exposed to. This may include information from media outlets or other personal motivations that may drive an individual to panic buy. Hence, the model proposes that:

**H7.** Observational learning has a direct effect on perceived scarcity

Fig. 1 shows the hypotheses that are proposed. To summarise, four social determinants are proposed to influence perceived scarcity. In addition, perceived scarcity is hypothesised to influence PB directly and indirectly via anticipated regret.

### 3. Research methodology

The proposed theoretical model (Fig. 1) along with the respective hypotheses (H1 to H7) are to be tested using the Structural Equation Modelling (SEM) method. SEM examines relationships between numerous latent constructs simultaneously with the consideration of measurement errors. It is a technique widely adopted in social sciences research, which often attempts to identify and rationalise a causal structure among a set of unobservable variables. The following sections expand on this process.

#### 3.1. Data collection procedure

A survey questionnaire was designed to collect data from Singapore’s population. Qualtrics, an independent third-party survey company, was engaged to design and conduct the survey. The survey was administered online and by invitation of a number of the company’s partnering panels. Engaging the services of the survey company incurred a one-time fee of SGD$7,000, part of which were allocated as monetary rewards for qualified participants. A soft launch was first conducted to allow for any modifications to the questionnaire, after which the finalised set was then used for official data collection.

The questionnaire survey comprises three sections. Section 1 introduces the survey topic and context, where participants were asked to answer the questions based on their experience to the grocery store following the announcement of lockdown measures. Statements to assure participants of confidentiality and anonymity in their information and responses followed. As one of the key parameters of this survey requires respondents to be aged 16 years and above, the section thus ended with a qualifying question to filter participants that do not fall into the required age group.

Subsequently, Section 2 prompts respondents to rate the

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**Fig. 1.** The theoretical model.
measurement items on a 9-point Likert scale. Attention checkers were also incorporated into the questionnaire where respondents were required to select a particular range of the scale as the answer (e.g., please select ‘4’ to this question). These checks serve to identify and exclude poor responses from the overall data collected. Section 3 closes the survey with general questions relevant to the demographics of the respondents.

3.2. Survey instrument

For empirical analysis, measurement items for the latent variables were designed in the form of a survey questionnaire. When completing the survey, participants were asked to recall their visit to the grocery store when COVID-19 lockdown measures were first announced in Singapore in April 2020. A nine-point scale of 1 = completely disagree to 9 = completely agree was used. Appendix 1 gives an overview of the constructs and their corresponding measurement items.

Measuring Coercive Social Influence (CSI) involved gauging the respondent’s agreement with the effectiveness of regulatory and economic instruments implemented by the Singapore government. The effectiveness of peer sanction against public hoarding was an additional measure as well (Sheu and Kuo, 2020). Non-Coercive Social Influence (NSI) was measured according to how the respondents viewed public sentiments and observations. One measure was the public’s acceptance towards product stockpiling for risk mitigation. This item however was subsequently removed due to poor factor loading. Two more substantial measures required the respondents to assess if the public had a fear of product price and supply volatility, as well as the general observation of people rushing to panic buy during this period (Sheu and Kuo, 2020).

For Social Norm (SCN), participants were asked to consider four main social groups – friends, family members, colleagues/classmates, and other people who are important – and their acceptance towards product stockpiling (Gong et al., 2019). The frequency of observing the above-mentioned social groups in product stockpiling was also generated as a measure to operationalise Observational Learning (OBL) (Wang and Yu, 2017). As for Perceived Scarcity (PCS), four measures were created to assess the respondent’s opinion on product availability.

The items were with respect to the products that the respondent wanted, their opinion on product availability. The items were with respect to the products that the respondent wanted, the type of brand preferred, the size and the product range (Byun and Sternquist, 2008).

The four measures adopted for Anticipated Regret (APR) was intended to reflect feelings of the respondents if they had chosen not to stockpile products. In particular, respondents were asked if they would regret or feel sorry about their decision at a later point in time, feel as if they have not prepared enough for the COVID-19 situation, and if they feel that they would be judged for not buying enough (Gupta and Gentry, 2019; Khan et al., 2019).

Lastly, another four measures were developed for Panic Buying (PNB) to understand the respondent’s purchasing behaviour at the time when the lockdown was announced. The items include how respondents had the urge to grab products immediately, grabbing particular products that they did not intend to buy prior to the trip to the store, spontaneously grabbing products of interest, and buying of more products than usual (Byun and Sternquist, 2008; Sheu and Kuo, 2020).

3.3. Sample

Data collection concluded with a total of 507 valid responses. A look into the demographic profile (Table 1) of the participants show a balance in male (51%) and female (49%) respondents. The average age of the respondents hovered around 35 years old, with close to half (49%) of the total sample falling within the age group of 16–24 years old. Accordingly, the younger age profile correlates with a higher shopping frequency, with about half of the respondents doing so as often as a few times a month (51%) to even a few times a week (27%). A good proportion of respondents were diploma (29%) and/or degree holders (44%) as well and a larger proportion of respondents fell within the lower to middle-income range (55%).

There is a possibility of a non-response bias, whereby non-respondents of the survey may have differing characteristics from the individuals who have responded, resulting in a bias in the data collected. This was addressed by adopting the extrapolation approach, which suggests that participants who submitted a delayed or late response are more likely non-respondents. A non-response bias could therefore be inferred from a comparison between the early and late respondents. To do so, t-test of mean differences for the first 50% and the last 50% of respondents was conducted. Results concluded with no significant deviations between the two groups, indicating that non-response bias is not a major concern for this study.

It is acknowledged that the rigour of this research may be affected by a Common Method Bias (CMB). CMB is a systematic covariance in the relationships between constructs, attributable to the measurement method adopted. For cross-sectional studies such as this, it has been recognised that using one common method to obtain data – especially survey questionnaires – artificially inflates the estimates of the relationships (Jordan and Troth, 2019).

To determine if CMB exists, the Harman’s single factor test was applied to examine the extent to which one factor accounts for the covariance between constructs, ideally less than 50%. Accordingly, all variables were introduced into an exploratory factor analysis with loadings of the scale items being constrained to one factor. Results generated a variance of 37%, concluding that CMB is not an issue for this study.

4. Results

The following section follows a two-step process to present the results of the model. First, a Measurement Model Analysis is conducted to determine if the proposed latent constructs demonstrate good fit – if they are viable, valid and reliable for input into the structural equation model. To do so, a goodness-of-fit test is performed and the results of

| Table 1 | Demographic profile. |
|---------|----------------------|
| Characteristics | Item | Frequency (n=507) | Proportion (%) |
| Gender | Female | 246 | 49 |
| | Male | 261 | 51 |
| Age (years) | 16–34 | 248 | 49 |
| | 35–49 | 192 | 38 |
| | 50 and above | 67 | 13 |
| Education | Below Secondary | 1 | 0 |
| | Secondary | 35 | 7 |
| | Post-Secondary | 40 | 8 |
| | University | 147 | 29 |
| | Graduate | 222 | 44 |
| Housing | Postgraduate | 62 | 12 |
| | HDB (public housing) | 394 | 78 |
| Household Income | Condominium | 85 | 17 |
| (SGĐ/Month) | Landed | 24 | 5 |
| | Others | 3 | 1 |
| | 0 | 4 | 1 |
| | 1,999 | 99 | 20 |
| | 4,000–7,999 | 179 | 35 |
| | 8,000–11,999 | 121 | 24 |
| | 12,000–19,999 | 79 | 16 |
| | >20,000 | 25 | 5 |
| Shopping Frequency | Almost never | 2 | 0 |
| | Few times a year | 85 | 17 |
| | Few times a month | 257 | 51 |
| | Few times a week | 139 | 27 |
| | Daily | 24 | 5 |

* Variable used as a control factor in the theoretical model.
four key indices will be interpreted accordingly. They include the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA) and Standardised Root Mean Square Residual (SRMR). Subsequently, the relationship between each construct and its respective measurement items are evaluated based on computed factor loading values (λ). The Average Variance Extracted (AVE) is then checked to assess the validity of the constructs. Particularly, AVE value in itself will assess if convergent validity exists, while a comparison between the AVE values of two constructs and their squared correlations will establish if there is discriminant validity. Lastly, Composite Reliability (CR) validates the reliability and consistency of the overall measurement scale.

The second step involves performing a Structural Model Analysis to test the structural relationship between the constructs and the proposed hypotheses. Herein, the parameter estimates give an insight into the significance and strength of relationship between constructs, and the Squared Multiple Correlation (R²) component will express the explanatory power (Yuen et al., 2020b) of the model variables. Subsequently, a breakdown the variable effects into direct, indirect and total effects will offer a better interpretation of the causal paths and their inter-relationship.

4.1. Measurement Model Analysis

The overall results of the goodness-of-fit test (Table 2) indicate a good model fit. CFI and TLI values are above the pre-established criteria of 0.95 for both components and the RMSEA and SRMR values are below the set threshold of 0.08. These statistics indicate that the statistical model corresponds well with the observed data.

The rest of the findings (Table 2) support the model fit as well. Factor loadings as generated are greater than the required minimum of 0.70, showing a strong association between the constructs and its corresponding measurement items.

The AVE values as derived are higher than the recommended level of 0.50, indicating that convergent validity exists and that the measurement items strongly represent its corresponding constructs. At the same time, discriminant validity is evident as the squared correlations between any two constructs do not surpass their respective AVE values.

Table 2

| Construct                          | Item | λ   | AVE | CR  |
|-----------------------------------|------|-----|-----|-----|
| Coercive Social Influence (CSI)   | CSI1 | 0.794 | 0.649 | 0.846 |
|                                   | CSI2 | 0.891 |      |     |
|                                   | CSI3 | 0.723 |      |     |
| Non-Coercive Social Influence (NSI)| NSI2 | 0.728 | 0.597 | 0.747 |
|                                   | NSI3 | 0.815 |      |     |
| Social Norm (SCN)                 | SCN1 | 0.907 | 0.792 | 0.938 |
|                                   | SCN2 | 0.912 |      |     |
|                                   | SCN3 | 0.884 |      |     |
|                                   | SCN4 | 0.855 |      |     |
| Observational Learning (OBL)      | OBL1 | 0.873 | 0.706 | 0.906 |
|                                   | OBL2 | 0.873 |      |     |
|                                   | OBL3 | 0.791 |      |     |
|                                   | OBL4 | 0.822 |      |     |
| Perceived Scarcity (PCS)          | PCS1 | 0.797 | 0.732 | 0.916 |
|                                   | PCS2 | 0.880 |      |     |
|                                   | PCS3 | 0.880 |      |     |
|                                   | PCS4 | 0.863 |      |     |
| Anticipated Regret (ATR)          | ATR1 | 0.736 | 0.718 | 0.910 |
|                                   | ATR2 | 0.889 |      |     |
|                                   | ATR3 | 0.882 |      |     |
|                                   | ATR4 | 0.874 |      |     |
| Panic Buying (PNB)                | PNB1 | 0.836 | 0.690 | 0.899 |
|                                   | PNB2 | 0.836 |      |     |
|                                   | PNB3 | 0.809 |      |     |
|                                   | PNB4 | 0.841 |      |     |

Model fit indices: χ²/df = 2.224, (p < 0.05, df = 255); CFI = 0.97; TLI = 0.96; RMSEA = 0.05; SRMR = 0.03.

The social constructs also have an indirect effect on both anticipated regret and panic buying, with non-coercive social influence (a23 = 0.111), observational learning (a23 = 0.042) and social norm (a23 = 0.067) having more weight on the latter. A higher effect for panic buying could be due the number of paths that these exogenous variables are channelled through. The indirect effect of the social constructs on panic buying is 0.265. The sole direct motivator of anticipated regret, and that it also directly influences PB (a53 = 0.213). Anticipated regret (a53 = 0.506) however shows a larger direct effect on PB, compared to that of perceived scarcity.

4.3. Direct, indirect and total effect analysis

The inter-relationship between constructs can be better interpreted through its direct, indirect and total effects. Table 5 gives an overview of the corresponding effects of exogenous variables on endogenous variables.

As theorised, the social determinants, namely non-coercive social influence (a23 = 0.319), observational learning (a23 = 0.194) and social norm (a41 = 0.120), have a direct influence on an individual’s perception of scarcity. The results also support that perceived scarcity (a52 = 0.265) is the sole direct motivator of anticipated regret, and that it also directly influences PB (a53 = 0.213). Anticipated regret (a53 = 0.506) however shows a larger direct effect on PB, as compared to that of perceived scarcity.

The social constructs also have an indirect effect on both anticipated regret and panic buying, with non-coercive social influence (a23 = 0.111), observational learning (a23 = 0.042) and social norm (a43 = 0.067) having more weight on the latter. A higher effect for panic buying could be due the number of paths that these exogenous variables are channelled through. The indirect effect of the social constructs on panic buying is 0.265. The sole direct motivator of anticipated regret, and that it also directly influences PB (a53 = 0.213). Anticipated regret (a53 = 0.506) however shows a larger direct effect on PB, compared to that of perceived scarcity.
anticipated regret is only channelled through one path (that is, observational learning \(\rightarrow\) perceived scarcity \(\rightarrow\) anticipated regret), while the indirect effect of the social constructs on PB is channelled through two paths (that is, 1. observational learning \(\rightarrow\) perceived scarcity \(\rightarrow\) panic buying, and 2. observational learning \(\rightarrow\) perceived scarcity \(\rightarrow\) anticipated regret \(\rightarrow\) panic buying). With that said, the magnitude for each respective endogenous variable does not differ significantly from each other. Perceived scarcity \(a_{53} = 0.134\) as an exogenous variable also has an indirect effect on panic buying, through its influence on anticipated regret.

With respect to the total effects, non-coercive social influence \(a_{21} = 0.319\) has the highest effect on perceived scarcity with almost twice the effect size of the other two social determinants. Similarly, perceived scarcity also has a considerably high total effect on anticipated regret \(a_{52} = 0.265\) with effect magnitudes two times larger than that of its preceding social determinants. Anticipated regret \(a_{63} = 0.506\) generated the largest effect size on PB while perceived scarcity \(a_{53} = 0.347\) followed, having both a direct and indirect influence on PB through anticipated regret. As for the social determinants, non-coercive social influence \(a_{23} = 0.111\) has the highest and considerably larger total effect on PB than the other two determinants. Based on these findings, it is clear that non-coercive social influence, perceived scarcity and anticipated regret play a substantially larger role in triggering PB behaviour.

5. Discussion

The review of the path estimates first show that perceived scarcity has a positively significant effect size \((b = 0.213, p < 0.05)\), confirming that perceived scarcity has a positive influence on PB behaviour \((H_1)\). An individual is more likely to panic buy when he perceives an item to be scarce or limited \((Arafat et al., 2020b; ÇINAR, 2020)\). This perception could be heightened due to unforeseen developments such as the

| Table 4 | Hypotheses testing results. |
|---|---|---|---|
| Hypothesis | Standardised Effects | \(p\) | Outcome |
| Perceived Scarcity \(\rightarrow\) Panic Buying | 0.213 | <0.01 | Accept |
| Perceived Scarcity \(\rightarrow\) Anticipated Regret | 0.265 | <0.01 | Accept |
| Coercive Social Influence \(\rightarrow\) Perceived Scarcity | -0.084 | >0.05 | Reject |
| Non-coercive Social Influence \(\rightarrow\) Perceived Scarcity | 0.319 | <0.01 | Accept |
| Social Norm \(\rightarrow\) Perceived Scarcity | 0.194 | <0.01 | Accept |
| Observational Learning \(\rightarrow\) Perceived Scarcity | 0.120 | <0.01 | Accept |

| Table 5 | Direct, indirect and total effects. |
|---|---|---|
| Exogenous (i) | Endogenous (j) | Anticipated Regret (2) | Panic Buying (3) |
| Perceived Scarcity (1) | 0.213 | 0.347 | 0.213 |
| Anticipated Regret (6) | 0.506 | 0.506 |
| Direct Effects \((a_{ij})\) of... | Coercive Social Influence (1) | - | - |
| Non-Coercive Social Influence (2) | 0.319 | - | - |
| Observational Learning (3) | 0.194 | - | - |
| Social Norm (4) | 0.120 | - | - |
| Perceived Scarcity (5) | 0.265 | 0.265 |
| Indirect Effects \((b_{ij})\) of... | Coercive Social Influence (1) | - | - |
| Non-Coercive Social Influence (2) | 0.085 | 0.111 |
| Observational Learning (3) | 0.032 | 0.042 |
| Social Norm (4) | 0.051 | 0.067 |
| Perceived Scarcity (5) | - | 0.134 |
| Anticipated Regret (6) | - | - |
| Total Effects \((c_{ij})\) of... | Coercive Social Influence (1) | - | - |
| Non-Coercive Social Influence (2) | 0.085 | 0.111 |
| Observational Learning (3) | 0.032 | 0.042 |
| Social Norm (4) | 0.051 | 0.067 |
| Perceived Scarcity (5) | 0.265 | 0.347 |
| Anticipated Regret (6) | - | 0.506 |
COVID-19 pandemic which, given its intensity, can affect one’s freedom of choice in light of an uncertain outcome (Arafat et al., 2020b).

Anticipated regret is also found to have a positively strong influence on PB behaviour ($b = 0.506$, $p < 0.05$) (H$_2$), notably the highest magnitude relative to other path estimates. In making purchase decisions, potential decision errors are often considered (Simonon, 1992) and the regret minimising alternative (Amin et al., 2018; Zeelenberg, 1999) would be preferred under the uncertainty of supply chain disruptions during the COVID-19 Pandemic. This would be further amplified at the heightened phase of the pandemic, during whence the survey was conducted. Many individuals would have naturally anticipated a greater sense of uncertainty of the future considering an impending nationwide lockdown (Jin et al., 2020). The result further confirms that under scarcity conditions, people tend to be more possessive regardless of the immediate need of a product (Byun and Sternquist, 2008, 2012), seeing as individuals would have purchased more of a particular product or purchased other products that under normal circumstances would not have been necessary.

H$_3$ is also supported, whereby perceived scarcity is shown to have positive influence on feelings of anticipated regret ($b = 0.265$, $p < 0.05$). The concept of scarcity prompts negative emotions such as anticipated losses because it limits product availability and one’s freedom of choice (Byun and Sternquist, 2012; Lesnne and Venkatesan, 1989). Individuals in such situations are more sensitive to the emotional or psychological outcomes of their purchase decisions (Byun and Sternquist, 2012; Kartika, 2019; Yuen et al., 2020a). Moreover, the situation of limited availability i.e. supply disruptions amidst a global pandemic, also contributes to the extent of the preference increase (Verhallen and Robben, 1994) due to the great amount of uncertainty and risk involved. Under such circumstances, individuals will not only be more concerned about the potential payoffs of their decision choice, but will also place more consideration on the foregone payoffs, if they had chosen differently (Loomes and Sugden, 1982; Somasundaram and Diecide, 2017). For these reasons, an increased perception of scarcity evokes greater feelings of anticipated regret.

The remaining results confirm a direct relationship between perceived scarcity and three of the four proposed social antecedents – Non-coercive social influence (H$_4$), social norm (H$_5$) and observational learning (H$_7$). Non-coercive social influence had the largest impact on perceived scarcity ($b = 0.319$, $p < 0.05$), ascertaining that exposure to information through media platforms or words of mouth can change individual’s perception of scarcity. Although technological advancements have enabled instantaneous access to information and more freedom in the communication, abuse of these systems can have adverse implications. Certain media sources manipulate or exaggerate information so as to garner more attention and website traffic. Social media networks are also dominated by user-created information which often are opinionated and biased (Ashuri et al., 2018). Hence, individuals who are unable to distinguish credible or reliable information sources are more susceptible to false information. Given that this was an issue during the 2013–2016 West Africa Ebola Epidemic (Sell et al., 2020) as well as the current COVID-19 Pandemic (Nheimerly and Fares, 2020), the power of misinformation in intensifying one’s perception of scarcity during a pandemic outbreak cannot be under-estimated. These justifications therefore support the acceptance of H$_4$.

Social norm ($b = 0.194$, $p < 0.05$) is also shown to be directly linked to perceived scarcity, thereby confirming H$_5$. The results support the reasoning that a modification or collapse of a social norm can influence one’s perception of scarcity. PB has been long established as an undesirable social behaviour within communities because of its negative impact on inventory and supply chain systems. During the COVID-19 Pandemic however, people became more accepting of this previously undesirable behaviour. This change is in line with the Emergent Norm Theory, which rationalises that social norms can change or develop in response to a precipitating crisis. As such, an individual may perceive products to be scarcer when more people become approving of PB behaviour.

Lastly, a significant effect size for H$_7$ shows that observational learning also has a direct effect on perceived scarcity ($b = 0.120$, $p < 0.05$). This corroborates with Bandura (1977)’s Social Learning Theory whereby behaviour, attitudes and reactions can be learned from the observation of others. A key indicator of increased scarcity is when the demand for a product increases. Similarly, directly observing other people buying more products or observing a sudden surge of people at the grocery store can lead an individual to worry about the availability of a product in the future, thereby increasing their perception of scarcity. One’s perception is also intensified in unprecedented situations (Cherry, 2019) and if the individual lacks outside information to comprehend the situation (Yuen et al., 2020a). The COVID-19 Pandemic exemplifies this, as its scale and severity has been one that Singapore has not encountered previously. With limited guidelines, it presented a challenge for both the authorities as well as social groups to process and adapt to the vast amount of information being circulated. Observing people engaged in panic buying would hence have played a more direct part in influencing one’s perception of scarcity. Hypothesis (H$_7$) is thus accepted.

Apart from the above findings, the significance of the control variable shopping frequency ($b = 0.118$, $p < 0.05$) also appears to be relevant to the observational learning construct. By going out and shopping more often, one is able to observe and learn more about how society acts and interacts, especially in response to key events such as the COVID-19 Pandemic situation and the resulting announcement of lockdown measures. Its significance is therefore noted.

As for coercive social influence, results indicate that government intervention and peer sanctions have little influence on an individual’s perceived scarcity ($p > 0.05$). This may be the case for Singapore as the measures implemented by the government were not completely restrictive. For instance, during the Circuit Breaker lockdown, businesses that provided essential products and services still remained open. This included supermarkets, pharmacies, restaurants as well as food suppliers and manufacturers. This assures citizens that they are able to purchase essential items when needed and as such, people would not have perceived a greater sense of scarcity despite the lockdown measures. H$_4$ is therefore rejected.

Overall, the model is largely consistent with the existing literature. For example, the significant direct relationship between perceived scarcity and PB is supported by Li et al. (2021) and Yuen et al. (2021). However, the relationship is not supported by Omar et al. (2021) who found that the effect of perceived scarcity on PB is fully-mediated by anxiety. On the relationship between anticipated regret and PB, the significant effect is consistent with Chua et al. (2021). Concerning the rest of the hypotheses which relate to the effects of the social factors on perceived scarcity, no similar studies exist that are suitable for comparisons. However, the significant effects are supported by social learning theory which posits that social factors serve as stimuli that trigger a cognitive (i.e. mental thought) process. In this context, the cognitive process includes the perception of scarcity and anticipated regret. Consequently, the theory proposes that the cognitive process triggers a behaviour, which in this context, refers to PB.

6. Implication

6.1. Theoretical contributions

This research offers several theoretical contributions to the field of behavioural and social psychology. First, given the rarity in occurrence of PB behaviour, there exists limited understanding into the underlying mechanisms of the phenomenon. With just over two hundred published papers on Scopus, most of these studies focused on the psychological causes as well as the implications of such behaviour on different groups. It is therefore the intention to establish an alternative perspective, specifically as to how PB behaviour can be a socially-influenced action as
well. To do so, this study builds on established concepts of scarcity and perception. While these have been addressed by authors including Yuen et al. (2020a) and Arafat et al. (2020b), current research acknowledges that an individual’s purchase decision is made contextually according to their surrounding circumstances, with emphasis on the commodity and reactance theory. This study therefore addressed four social antecedents of perceived scarcity and its resulting influence on PB behaviour. Past literature in consumer behaviour research have also examined the significance of anticipated regret in purchase decisions (Javad Nasiry, 2009; Khan et al., 2019). This study substantiates this theory by integrating anticipated regret into the theoretical framework. The result accordingly shows its significance, having the strongest effect size on PB behaviour.

Next, numerous social theories are synthesised to offer an expanded overview into the social factors that can alter one’s perception of scarcity. For social influence, this study builds on Sheu and Kuo (2020)’s interpretation of social influence which is based on the power of coercive and non-coercive social influence. Sheu and Kuo (2020), however, applied these constructs to a wholesale-retailer supply chain relationship. Gelderman et al. (2008) and Hausman and Johnston (2010) similarly utilised this social influence concept with respect to normal market coercive strategies. Hence, this study expands the application of coercive and non-coercive social influence to its influence on perceived scarcity. The analysis has offered new insights into these constructs. A positive result is generated for non-coercive influence, but coercive influence is found to have little impact on perceived scarcity, suggesting that an individual does not perceive governmental interventions and restrictions as an indicator of increased scarcity.

Another contributing aspect is the connection between social norm and perceived scarcity. Previous literature have identified social norms as behaviours adopted during the COVID-19 crisis and focused on social norm compliance such as purchasing of masks or hand sanitisers (Yang et al., 2020). This study instead suggests that under the Emergent Norm theory, a modification of a social norm can alter one’s perception of scarcity. Under normal circumstances, PB behaviour is an existing social norm that is frowned upon by society, therefore it is hypothesised and subsequently shown that a sudden change in attitude towards this norm can be an indicator of a precipitating crisis, heightening one’s perception of scarcity as well. The present findings support this explanation and hence, thereby adding another dimension to the theoretical application of the social norm construct.

The present research additionally contributes to the social learning theory, expanding on the principle of observational learning. Existing literature briefly touches on observational learning (Ashuri et al., 2018; Wang and Yu, 2017), with only a few applying it in the context of panic buying (Yuen et al., 2020a). Here, observational learning modelling through behavioural or live sources is analysed and confirmed with a significant effect on perceived scarcity, thereby ascertaining its relationship. Lastly, as this study was conducted during the early stage of the COVID-19 pandemic, the data reflect responses under naturally occurring scarcity conditions, as opposed to artificial conditions created by marketers and retailers (Gupta, 2013).

6.2. Policy implications

The findings of this study can have several implications on policymakers as well as businesses. Understanding the impact of an individual’s social environment on his perceptions and how such feelings are manifest across social boundaries can aid stakeholders in developing intervention and support strategies to cope with the current as well as future health risks.

First, recognising that perceived scarcity mediates the motivation of PB behaviour, the stakeholders should therefore look towards managing the public’s perception of scarcity at critical stages of the pandemic outbreak. Among the three significant factors, non-coercive social influence has the strongest impact on perceived scarcity. Non-coercive social influence is regarded as information exchanges and recommendations, which in today’s society, is largely communicated through multi-media sources such as the television, radio, internet and social media. The nature of these platforms, especially with the internet and social media, allows more user content to be circulated and at a faster rate as well. Not only does vast amount of negative or false information heighten one’s perception of scarcity, but the lack of information also encourages individuals to look to other sources for answers. Governmental authorities should therefore utilise these platforms to constantly share situational updates or initiate campaigns to spread positive messages. Policymakers can involve business marketers and social media influencers in these campaigns to spread the messages and reassure consumers that there is sufficient stock of goods or that there are plans underway to ensure that the supply of products are not hindered. Transparency in information will help foster more trust in the government, thereby increasing the effectiveness of official messages being disseminated. Addressing the presence of non-credible information circulating within these networks is also important. Efforts should be placed on educating the public about the use of internet and social media, particularly on how to discern reliable information sources.

Next, the issue of observing PB behaviour can be indirectly addressed if businesses work closely with the local governments. It is understood that human behaviour is complex and difficult to predict, even more so with uncertainty and unforeseeable nature of a pandemic outbreak. Hence, there should be collective efforts between stake-holding parties – more so on the part of the government – to monitor the escalation of the pandemic. This will be more applicable for businesses that sell essential goods such as toilet paper or packaged food as according to past events, these have been the key items that consumers panic buy. Haying access to information at the early stages allows businesses to prepare for the increased demand that they may face once the public is aware of the situation. Businesses should also take additional steps to assess their supply chain and develop alternative solutions in the event of a breakdown in the network. This was evident during the COVID-19 Pandemic, which forced manufacturing plants and transport operators to shut down for a period of time. Holding more inventory for essential items would be one option, but from a business’s perspective it incurs more costs. Policymakers could therefore look into developing incentives for key suppliers of essential items to hold more inventory. An alternative option would be to look into more regional or local suppliers for goods that would grant a more direct and quicker supply of goods.

Businesses could also play a part in reducing the impact of observational learning by limiting the number of people shopping in the stores at one time or imposing purchase limits. This will reduce the perception of large crowds rushing in and grabbing items off shelves or even observing baskets or trolleys stocked up with products. Alternatively, they could leverage on the increasing trend of online shopping, thereby allowing customers to conduct online purchases and offering delivery services. Lastly, this study can be beneficial in educating the public on social responsibility. It is important that the government takes continual steps to build trust and cohesion amongst citizens so that in the event that an unprecedented health crisis occurs, the public is more informed and prepared to deal with the situation.

6.3. Limitations and recommendations

There are several limitations to the current study. First, as this study was only conducted in Singapore, the results reflect a demographic that may be different in the context of other countries. Singapore is a developed city-state with high accessibility to healthcare and basic needs such as shelter, food and water. At the same time, Singapore relies heavily on imported goods, with more than 90 per cent of food being imported. Therefore, the findings in this study may not be directly or fully applicable to other countries in which citizens are able to be self-sufficient in obtaining basic necessities or for those who do not have good accessibility to such products or services. Future research can
therefore cross-validate these findings by including other countries. Another limitation is that this research was conducted through an online survey which produced a limited data set of just over five hundred valid responses. Although this single method did not present any common method bias in this paper, future studies can look into other sources of data collection in order to capture a larger and wider demography of the respondents. Given that the nature of the research and data is largely subjective and based on personal perception and experiences, future research can look into incorporating data analysis of supermarket chains to offer insights into PB trends, which can help to substantiate social observations and findings of PB behaviour.

The next limitation is that the scope of this research only considers four social factors and its direct relationship on one’s perception of scarcity. It is possible that there may be more social variables as well as other psychological reactions that can influence PB behaviour. It is therefore recommended that future studies look into other theoretical perspectives not covered in this study to expand on the existing literature. Lastly, as this research was conducted during the COVID-19 pandemic, the relevancy of the findings to future diseases outbreaks would differ and as such should be taken into account when applying to future research.

Appendix

Table A
Measurement Items

| Construct                      | ID    | Measurement Item | Adapted Source                  |
|-------------------------------|-------|------------------|---------------------------------|
| Coercive Social Influence (CSI) | CSI1  | The regulatory instruments adopted by the government are effective to regulate products during COVID-19 | Sheu and Kuo (2020) |
|                               | CSI2  | The economic instruments (e.g., fines and subsidies) adopted by the government are effective to regulate products during COVID-19 | Sheu and Kuo (2020) |
|                               | CSI3  | The peer sanction against product hoarding is effective to regulate products during COVID-19 | Sheu and Kuo (2020) |
| Non-Coercive Social Influence (NSI) | NSI1  | The media portrays product stockpiling for risk mitigation during COVID-19 is acceptable to the public* | Sheu and Kuo (2020) |
|                               | NSI2  | The media portrays public fear for the volatility of product prices and supply shortage during COVID-19 | Sheu and Kuo (2020) |
|                               | NSI3  | The media portrays the public frequently rush into a panic buying for products during COVID-19 | Sheu and Kuo (2020) |
| Social Norm (SCN)              | SCN1  | Friends          | Gong et al. (2019)              |
|                               | SCN2  | Family Members   |                                |
|                               | SCN3  | Colleagues/Classmates |                                |
|                               | SCN4  | Other people who are important to me |                                |
| Observational Learning (OBL)  | OBL1  | Friends          | Pourrazavi et al. (2014); Gong et al. (2019) |
|                               | OBL2  | Family Members   |                                |
|                               | OBL3  | Colleagues/Classmates |                                |
|                               | OBL4  | Other people who are important to me |                                |
| Perceived Scarcity (PCS)       | PCS1  | The products that I wanted to buy will be very limited during COVID-19 | Byun and Sternquist (2008) |
|                               | PCS2  | The brand availability for a product will be very limited during COVID-19 | Byun and Sternquist (2008) |
|                               | PCS3  | The sizes of a product will be very limited during COVID-19 | Byun and Sternquist (2008) |
|                               | PCS4  | The types of products will be very limited during COVID-19 | Byun and Sternquist (2008) |
| Anticipated Regret (AFR)       | ATR1  | I would regret later | Khan et al. (2019); Gupta and Gentry (2019) |
|                               | ATR2  | I would feel sorry about my decision later |                                |
|                               | ATR3  | I would feel that I had not done enough to prepare for COVID-19 |                                |
|                               | ATR4  | I would feel that others would judge me for not buying enough |                                |
| Panic Buying (PNB)             | PNB1  | I had the urge to grab products immediately | Byun and Sternquist (2008); Sheu and Kuo (2020) |
|                               | PNB2  | I found a number of things I wanted to grab immediately even though they were not on my shopping list | Byun and Sternquist (2008); Sheu and Kuo (2020) |
|                               | PNB3  | I spontaneously grabbed the product of interest |                                |
|                               | PNB4  | I bought more products than I usually would |                                |

* Item removed due to poor factor loading.

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