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Panic buying in times of coronavirus (COVID-19): Extending the theory of planned behavior to understand the stockpiling of nonperishable food in Germany

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ABSTRACT

At the onset of the coronavirus pandemic, sales of nonperishable food drastically increased in Germany. Reports of hoarding and panic buying flooded the media. To identify the drivers of the increased sales of these products, we carried out an online survey with $n = 495$ people living in Germany. We followed a concurrent triangulation design. For the quantitative analysis, we extended the theory of planned behavior to identify possible reasons for stockpiling nonperishable food. The results suggest that “attitude,” “subjective norm,” and the “fear of future unavailability” were main drivers of stockpiling behavior in our sample. Additionally, we analyzed answers to open questions capturing participants’ own explanations of why they did or did not stockpile nonperishable food. By contrasting the results, we found that our qualitative results validate some of our quantitative findings but also deliver new insights. For instance, a key stated reason for stockpiling nonperishable food was to reduce shopping frequency.

1. Introduction

When the World Health Organization (WHO) announced that coronavirus disease (COVID-19) was a global pandemic on March 11, 2020, a change in food-related consumer behavior became apparent in Germany. Restaurants, takeaways, and canteens closed and there was a substantial increase in sales of nonperishable food (e.g., noodles, flour, canned food). In Germany the demand for canned fruits and vegetables was considerably above average from March 9 to 15, with an increase of 126% (canned fruits) and 137% (canned vegetables) (Statistisches Bundesamt, 2020a). Though sales decreased at the end of March and beginning of April, they remained above average for nonperishable foods. For example, depending on the week, in March rice showed sales between +27% and +208% and flour between +105% and +139% as compared to the averages of the previous six months. Pasta and strained tomatoes showed a similar pattern of sales (Statistisches Bundesamt, 2020a). Such above-average purchases occurred not only for nonperishable food, but also for fresh fruits and vegetables, though in smaller amounts (Statistisches Bundesamt, 2020a). Similar to the developments in Germany, Benker (2020) observed for the U.K. pandemic context, that a change in the kinds of food procured took place, as well as a change in meal planning, indicating a modification in food intake.

A number of studies on psychological responses to past pandemic crises can explain such “panic-buys” in times of COVID-19. During the severe acute respiratory syndrome (SARS) outbreak in 2003, a study in Singapore investigated the psychosocial and coping responses among the general population (Sim, Huak Chan, Chong, Chua, & Wen Soon, 2010). They found substantial rates of psychiatric morbidities related to SARS, such as somatic disorder, anxiety, social dysfunction and depression. Major concerns expressed by study participants were losing control of the situation, fear of becoming infected, and health concerns about the family. Furthermore, the unpredictability of the situation and concerns about the impact on the economy were prevalent. For instance, a younger age and female gender were associated with greater anxiety. Studies on the ongoing COVID-19 pandemic found similar psychological reactions, for example, panic disorder, anxiety, depression, fear, and uncertainty about the future (Dubey et al., 2020; Hiscott et al., 2020; Somma et al., 2020; Wang, Xia, et al., 2020). Feelings of insecurity and uncertainty and the fear and feeling of losing control can trigger food hoarding and stockpiling in an attempt to take control of the situation and to reduce fear (Arafat et al., 2020; Dubey et al., 2020; Hendrix & Brinkman, 2013; Sim, Chua, Vieta, & Fernandez, 2020). Sensationalist headlines in the media in the early phase of COVID-19 and government measures to slow down the spread (social distancing, quarantine,

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lockdown) may have also added to fears about the scarcity of essential food and services (Depoux et al., 2020; Dubey et al., 2020; Nicola et al., 2020). This recent phenomenon has been coined as the “scarcity effect” (Pantano, Pizzi, Scarpì, & Dennis, 2020). According to social learning theory, people learn by observing the reactions of their surrounding fellows and gauge from their behavior the seriousness of a crisis (Arafat et al., 2020). Therefore, reporting on and learning about panic buying could have triggered other people to join the stockpiling (“group dynamic”).

Overall, research regarding previous societal disruptions indicate that consumer behavior and routines change during times of crisis (e.g., Ang, 2000). Consumers question their everyday purchasing habits and put more thought into what they buy and where they buy it. Habitual purchases decrease and the search for alternative products, for example cheaper brands, increase (Pantano et al., 2020; Roos & Gassert, 2010; Vlontzos & Duquenne, 2013). Money is only spent on things that are very important to the consumers (Roos & Gassert, 2010). People take more time to think about their purchases and put more effort into comparison shopping, leading to extensive decision-making behavior. Unplanned purchases decrease if the financial situation is tight. Accordingly, an insightful theoretical approach to understand consumer behavior during COVID-19 may be the “theory of planned behavior” (TPB) by Fishbein and Ajzen (e.g., 2011). This theory specifically focuses on planned and conscious behavior and highlights that people rarely have complete control over specific behaviors due to environmental influences. Consequently, Fishbein and Ajzen (2011) assume that behavior is the result of the individual’s intentions as well as the level of control over their behavior. Indeed, at the beginning of the crises, some environmental restrictions on buying behavior arose, thus limiting consumers’ control: several supermarkets limited the number of items each customer could buy, and in some situations, nonperishable products were out of stock. According to the TPB, the intention to carry out a behavior is determined by three central constructs: subjective norm, attitude, and perceived control. “Subjective norm” describes the individual’s overall evaluation of the normative expectations to carry out the behavior in question. “Attitude” is the assessment of the behavior, favorable or unfavorable. “Perceived control” is the evaluation of the extent to which the behavior in question is perceived as easy or difficult to perform. In principle, the more favorable the attitude and subjective norm, and the greater the perceived control, the stronger the individual’s intention to perform the behavior in question. Accordingly, we derive the four key hypotheses from the TPB:

Hypothesis 1. The stronger the intention to buy more nonperishable food than normal (hereafter: stockpiling) during the onset of the coronavirus pandemic was, the more stockpiling of nonperishable food took place.

Hypothesis 2. The stronger the subjective norm regarding stockpiling during the onset of the coronavirus pandemic was, the stronger the intention to stockpile became.

Hypothesis 3. The more positive the attitude toward stockpiling during the onset of the coronavirus pandemic was, the stronger the intention to stockpile became.

Hypothesis 4. The higher the perceived control regarding stockpiling during the onset of the coronavirus pandemic was, the stronger the intention to stockpile became.

While the validity of the principle elements of the TPB is well recognized, many scholars have put forward extensions of the theory to better understand the particularities of their research subject. Regarding consumption behavior, for example, Carfora et al. (2019) include trust and green self-identity in their analyses of purchasing behavior of organic milk. Nystrand and Olsen (2020) extend the TPB by including for example hedonic and utilitarian eating values to understand consumers’ attitudes and intentions toward consuming functional foods.

Following this practice of extending the TPB, we assume that neuroticism (emotional stability), one of the “big five” personality traits (Raad, 2000), may be useful in understanding stockpiling during COVID-19. Research has focused on neuroticism with regard to how people cope with stressful situations (DeLongis & Holtzman, 2005). Several studies found that resilience was negatively associated with neuroticism (Campbell-Sills, Cohan, & Stein, 2006; Oshio, Taku, Hirano, & Saeed, 2018; Riolli, Savicki, & Cepani, 2002). DeLongis and Holtzman (2005) studied the relationship between coping strategies and personality and found that people who have high levels of neuroticism are not generally bad copers, but they seem to choose less effective strategies to cope with the situation they face. First evidence from Denmark also suggests that stockpiling during COVID-19 was related to higher scores of neuroticism (Dammeyer, 2020).

Hypothesis 5. The more neurotic participants are, the stronger their intention to stockpile during the onset of the coronavirus pandemic was.

An additional potential driver of stockpiling behavior that the TPB does not cover is the consumers’ perception of the scarcity of nonperishable foods. Studies on hoarding suggest that the uncertainty of future product availability is a key driver of product hoarding (e.g., Byun & Sternquist, 2008; Gupta & Gentry, 2019). Accordingly, we test:

Hypothesis 6. The more pronounced participants’ fear of future unavailability of nonperishable food was, the stronger their intention to stockpile during the onset of the coronavirus pandemic was.

To draw conclusions on our hypotheses, we collected and analyzed data from consumers in Germany. The next sections explain our approach and results in detail.

2. Method and material

2.1. Data collection and questionnaire

To understand the reasons for stockpiling nonperishable food during COVID-19, we collected data from 495 consumers in the 18-to-65 age range in Germany online in May 2020. An external panel provider invited and incentivized participants to take part in the survey. We set quotas for age, gender, place of residence, and household income to obtain results similar to the German population between the ages of 18 and 65 years. After eliminating straight-liners for questions related to the TPB, a total of $n = 488$ datasets were used for the analysis (see Table 1).

The questionnaire was set up to tackle different research goals in the realm of horticultural consumer research and consisted of four essential parts. A first part covered participants’ sociodemographic characteristics. The second part was composed of questions, which had the aim to gain insights into fresh fruit and vegetables purchase behavior.¹ In a third part, we captured participants’ personalities. Lastly, we elicited participants’ behaviors and well-being during the coronavirus crisis, here the TPB-based questions relevant to the research aim were asked.² We carried out a pre-test to ensure the quality of the online questionnaire. This led to some adaptations and improvements, however not in the TPB-related part of the questionnaire.

On the first page of the questionnaire, the nature of the study was broadly explained for example in terms of our interest in food consumption decisions. However, the specific aim of understanding stockpiling nonperishable food was not mentioned. This mitigates concerns

¹ These questions are, from a conceptual point of view, unrelated to the stockpiling in focus here and thus are not included in the analysis.

² All TPB-relevant questions are displayed in the Appendix. A copy of the full questionnaire can be obtained from the corresponding author upon request.

Table 1
Summary statistics of the sample (n = 488).

Characteristic	Specification	Frequency	Percent (%)	Germany
Age ^a	18–29 years	110	22.5	21.6
	30–39 years	97	19.9	20.6
	40–49 years	100	20.5	19.4
	50–59 years	121	24.8	25.7
	60–65 years	60	12.3	12.7
Gender ^b	female	239	49.0	49.0
	male	249	51.0	51.0
Place of residence ^c	old states (former west)	401	82.2	80.5
	new states (former east)	87	17.8	19.5
Net household income ^b	€0–€1499	76	15.6	16.3
	€1500–€2499	110	22.5	18.6
	€2500–€4000	166	34.0	32.7
	>€4000	136	27.9	32.5
People in household ^d	1	97	19.9	21.1
	2	198	40.6	33.3
	≥3	193	39.5	45.5

^a Compared to people between 18 and 65 years in 2019, [Statistisches Bundesamt, 2019a](#).

^b Compared to people between 18 and 65 years in 2018, [GESIS-Leibniz-Institut Für Sozialwissenschaften, 2019](#).

^c Compared to all Germans in 2019, [Statistisches Bundesamt, 2019b](#).

^d Compared to all Germans in 2019, [Statistisches Bundesamt, 2020b](#).

that only those interested in the sensitive issues of stockpiling took place in the study (recruitment bias).³ We additionally specified that answers were stored anonymously and evaluated for research purposes.

2.2. Measurements

We identified TPB-related items in our research team. With the help of the pre-test we checked whether some obvious changes were necessary, which was not the case. Overall, the psychometric properties of the scale (cf. [Table 2](#)) provide confidence that our items successfully measured the respective constructs. All TPB-related questions are displayed in the Appendix.

Hypothesis 1: As proposed by [Fishbein and Ajzen \(2011\)](#), we specified the behavior by clearly defining it in terms of its target, action, context, and time elements. The behavior was consequently described as: “During the first two weeks of the lockdown due to the coronavirus (March 23 to April 6), I bought more nonperishable food than normal”. Before asking the question, we gave noodles, flour, and canned food as examples of nonperishable food. To capture and control for the effect of control of the behavior, as proposed by the TPB, we measured participants’ “intention to stockpile nonperishable food” by two similarly worded items.⁴ The “actual control” over the behavior was measured with two items in which we asked whether all nonperishable food was always available and whether there were buying restrictions on nonperishable food. “Perceived control” was captured with three similarly worded items pertaining to participants’ judgement as to whether they alone had control over their stockpiling behavior. For all described items, participants had to indicate how much they agreed with the specific statement on a scale ranging from “Do not agree at all” (=1) to “Agree completely” (=7) (cf. Appendix). Where applicable, scales were produced by calculating the arithmetic mean of respective items. All

³ 5 participants stopped the survey at the beginning of the stockpiling questions.

⁴ It should be noted that intention and behavior were simultaneously captured. Typically, it is advised to individually capture these concepts within two data collection phases. However, as the behavior of interest lay in the past, this was not possible.

Table 2
Frequencies (in %) of non-sociodemographic variables included as regression variables.

Scale/Variables (McDonald’s Omega, Cronbach’s Alpha) [#]	<4	4	>4		
<i>Regression 1</i>					
Stockpiling behavior	57.0	19.7	23.4		
Stockpiling intention (n/a, 0.954)	60.2	15.4	24.4		
<i>Control variables</i>					
Actual control (n/a, 0.640)	49.4	18.0	32.6		
Perceived control (0.887, 0.886)	12.9	10.2	76.8		
<i>Regression 2 (Block I)</i>					
Past stockpiling of nonperishable food	45.5	25.4	30.1		
<i>Regression 3 (Block II)</i>					
Subjective norm (0.922, 0.928)	57.2	11.9	30.1		
Attitude (0.960, 0.929)	61.5	5.5	33.0		
Perceived control (0.887, 0.886)	12.9	10.2	76.8		
<i>Regression 5 (Block IV)</i>					
Fear of future unavailability, i.e., perceived scarcity	59.6	19.5	20.9		
<i>Regression 4 (Block III) ^{##}</i>					
Neuroticism (0.612, 0.568)	1	2	3	4	Mean
	11.9	50.6	34.0	3.5	2

Note: [#] Omega can only be calculated with three items; ^{##} scale ranged from 1 to 4 and numbers are rounded.

scales in this research are calculated so that they reflect the hypothesized direction of influence between the constructs and the dependent variable(s). For example, the higher the numerical value of the “intention” scale, the stronger was participants’ intention to stockpile nonperishable food.

Hypothesis 2–4: We captured the “subjective norm” regarding stockpiling of nonperishable goods at the onset of lockdown with four items pertaining to participants’ judgements of both what others expected them to do and what others did themselves in terms of stockpiling. Again, participants were to indicate how much they agreed. Participants’ “attitude” was measured via a semantic differential, with four variables (good/bad; advantageous/disadvantageous; social/anti-social; useful/useless).

Hypothesis 5: To measure neuroticism, we used the Midlife Development Inventory (MIDI) scale ([Lachman & Weaver, 1997](#)). This scale has been widely and successfully applied in other food-related research (e.g., [Greibitus & Dumortier, 2016](#); [Peschel, Greibitus, Alemu, & Huhner, 2019](#)). Here, neuroticism is captured with four adjectives (moody, worried, nervous, and calm), and participants had to indicate how well these adjectives described them on a scale ranging from “A lot” (=1) to “Not at all” (=4). As suggested by [Lachman and Weaver \(1997\)](#), we re-coded the answers so that higher scale values indicate greater levels of neuroticism. Reliability analyses (Omega, Cronbach’s alpha) suggested dropping one item (calm) from the scale.

Hypothesis 6: The fear of future unavailability of nonperishable foods (perceived scarcity) was captured by the statement: “I was worried that I would not be able to buy enough nonperishable food in the future.” Participants were to indicate how much they agreed.

Additional control variables for the regressions: We used several standard socioeconomic control variables, such as gender, age, household income, and household size. Additionally, we controlled for past stockpiling behavior. We captured this with the statement, “I bought a lot of nonperishable food even before the coronavirus crisis,” and participants were to indicate how much they agreed.

Qualitative open question: To investigate the rationale for stockpiling or not stockpiling food without predefined categories, we used the following open questions: “For what reasons did you buy more nonperishable food than usual, or if you did not buy more than usual, why not?”

2.3. Data analysis

We followed a concurrent triangulation design. First, we used theory-guided quantitative data to draw conclusions on our hypotheses. Second, we analyzed participants' answers to the open questions. Third, to validate our results, we contrasted the outcomes from both analyses. We explain the analysis processes in detail below.

Quantitative data: To test **Hypothesis 1**, we followed the TPB and examined the effect of the "intention" of stockpiling nonperishable food on the "behavior" by controlling for moderation effects of "actual control" as well as "perceived control" over the behavior. Prior to the construction of the interaction terms, all variable controls were mean-centered. This aids in the interpretation of the results (Dalal & Zickar, 2012).

To investigate Hypotheses 2 to 6, we conducted hierarchical linear regression. This analysis process is in line with many other studies extending the TPB (e.g., McKee et al., 2019; Picazo-Vela, Chou, Melcher, & Pearson, 2010). We entered variables in four blocks:

- Block I: control variables
- Block II (Hypotheses 2–4): attitude towards the behavior, subjective norm, and perceived control
- Block III (Hypothesis 5): neuroticism
- Block IV (Hypothesis 6): fear of future unavailability

One key benefit of using the hierarchical linear regression analysis approach is that it allowed us to determine how much more of the variance in the dependent variable is explained due to the inclusion of the variables extending the TPB. The variance inflation factors were <2.3 in all regression models. This is well below the commonly recommended threshold of 10 for multiple regression analysis (e.g., Chatterjee & Hadi, 2012), and thus multicollinearity should not be an issue. As the Breusch-Pagan/Cook-Weisberg test indicated that heteroscedasticity is present in most models (i.e., the null hypothesis of homoscedasticity is rejected), we estimated and indicated robust standard errors where applicable. While the histograms of the residuals mostly look approximately normal,⁵ a Kolmogorov-Smirnov-Test cannot support this visual interpretation on a test basis (i.e., the null hypothesis of normal distribution is rejected). As this is a rather common phenomenon with real data, we assume, alongside many scholars (Ernst & Albers, 2017; Williams, Gómez Grajales, & Kurkiewicz, 2013), that our regression results are still robust due to our moderate to large sample size (central limit theorem).

Qualitative data: to analyze the open question of why participants did, or did not, stockpile nonperishable foods, we followed the main steps of a qualitative content analysis (Mayring, 2015). Specifically, we applied an inductive approach to building categories. To do so, we paraphrased each answer, compared the paraphrases, summarized, and generalized them, sorting them into different categories.

3. Results and discussion

3.1. Quantitative analysis results

Table 2 gives an overview of the means and standard deviations of all the non-sociodemographic variables included in the regressions. Perceived control is the only variable with majority of participants indicating a number above 4. Hence, most participants perceived to have control over their stockpiling behavior. Most participants had (i) a

⁵ According to Williams et al. (2013), normally distributed error terms allow inferences about the regression parameters in the population that a sample was drawn from, even when the sample size is relatively small. However, assumption of normal distribution of the error term is not relevant for multiple regressions to estimate regression coefficients that are unbiased and consistent.

negative attitude towards stockpiling nonperishable food, (ii) did not perceive that they were expected to stockpile (subjective norm), (iii) had no fear of future unavailability and (iv) had not stockpiled a lot of nonperishable food before the pandemic.

Regarding stockpiling behavior and intention 23.4%, respectively 24.4% of participants (rather, completely) agreed to have stockpiled nonperishable food, respectively have had the intention to stockpile, during the first two weeks of the lockdown. Overall, on average 23.2% more nonperishable food than usual was bought (cf. Appendix, question 1).

Hypothesis 1: **Table 3** shows that the intention to stockpile nonperishable food had a significant and substantial effect on respective behavior. Additionally, perceived control significantly moderates the effect of intention on behavior; however, this effect is comparably low. Overall, our results support **Hypothesis 1**.

Hypothesis 2–4: The change in (adjusted) R² from regression 2 to 3 indicates that the three central TPB constructs explain a substantial part (i.e., about 36%) of the variance in the intention to stockpile nonperishable goods (see **Table 4**). Results suggest that attitude and subjective norm are statistically significant and substantially influence participants' intention to stockpile nonperishable goods. These findings are robust, i.e., regardless of whether further variables are included in the regression (cf. regression 4 and 5). Thus, our results support **Hypotheses 2 and 3**.

Regarding the influence of perceived control, the results are more complex. Linear regression results for model 3a indicate that the effect of perceived control on intention is far less substantial (cf. coefficients) than the effect of attitude and subjective norm and not statistically significant on a 5% significance level. As this finding is surprising, a closer look at the partial regression diagrams indicated that the relationship between perceived control and intention may be curvilinear rather than linear. Thus, an exploratory analysis (regression 3b) with "perceived control" and its square instead of "perceived control" was included in the model. To assist in interpreting the results, we mean-centered "perceived control" (Dalal & Zickar, 2012). The results of regression 3b indicate that there is a significant negative curvilinear relationship between perceived control and intention. In other words, the more participants felt that they had control over buying nonperishable food, the less they were inclined to stockpile, and the effect accelerates with an increase in perceived control. However, regression results for model 5 suggest that this effect is not as robust as the effects of attitude and subjective norm. Overall, our results do not support a positive relationship between perceived control and intention, as predicted by the TPB (**Hypothesis 4**).

Hypothesis 5: The change in R² from regression 3 to 4 is zero, and the effect of neuroticism on the intention to stockpile is neither substantial nor statistically significant on a 5% level. Further statistical analysis shows that the Spearman's rho correlation between the two variables is low (r = 0.094) but statistically significant (p-value = 0.038). Overall, our results only partly support **Hypothesis 5**.

Hypothesis 6: The R² change from regression 4 to 5 is 5.6%, and the

Table 3
Hypothesis 1: Regression results.

	Unst. Coeff	p-value [#]
Constant	3.008	0.000
Intention	0.915	0.000
Perceived control	0.052	0.105
Actual control	0.001	0.973
Interaction effects		
Intention x Perceived control	0.067	0.008
Intention x Actual control	−0.004	0.6934
F-statistics	F(5,482) = 571.16	
Prob > F	0.000	
R ²	0.807	

Note: [#] robust standard errors.

Table 4
Hypotheses 2–6: hierarchical regression results.

	Regression 2		Regression 3a		Regression 3b		Regression 4		Regression 5	
	Unst. Coeff.	p-value	Unst. Coeff.	p-value [#]	Unst. Coeff.	p-value [#]	Unst. Coeff.	p-value [#]	Unst. Coeff.	p-value [#]
Constant	1.164	0.004	0.495	0.212	0.640	0.044	0.538	0.203	0.281	0.475
Block I										
Gender (1 = male)	0.163	0.307	-0.072	0.544	-0.104	0.376	-0.098	0.418	-0.068	0.557
Age (ref. group = 18–29)										
30–39	0.445	0.054	0.037	0.833	0.039	0.823	0.036	0.835	0.054	0.736
40–49	0.294	0.202	0.112	0.492	0.100	0.532	0.102	0.526	0.173	0.260
50–59	-0.111	0.616	-0.256	0.124	-0.283	0.084	-0.279	0.091	-0.192	0.216
>60	-0.211	0.432	-0.179	0.411	-0.155	0.468	-0.144	0.508	0.019	0.925
Household income (ref. group = 0–1500€)										
1501–2499€	0.172	0.489	-0.135	0.452	-0.123	0.489	-0.121	0.500	0.015	0.924
2500–4000€	-0.128	0.587	-0.250	0.133	-0.236	0.154	-0.232	0.162	-0.201	0.173
>4000€	-0.213	0.392	-0.259	0.139	-0.256	0.139	-0.248	0.158	-0.161	0.320
People in household	0.139	0.060	0.067	0.315	0.058	0.375	0.059	0.368	0.030	0.622
Past stockpiling of nonperishable food	0.339	0.000	0.110	0.005	0.095	0.017	0.093	0.018	0.050	0.175
Block II										
Attitude			0.316	0.000	0.321	0.000	0.322	0.000	0.267	0.000
Subjective norm			0.485	0.000	0.442	0.000	0.441	0.000	0.324	0.000
Perceived control			-0.053	0.196	-0.153	0.003	-0.151	0.004	-0.091	0.073
Perceived control ²					-0.083	0.000	-0.083	0.000	-0.063	0.002
Block III										
Neuroticism							0.037	0.669	0.013	0.877
Block IV										
Fear of future unavailability									0.294	0.000
F-statistics	F(10,477) = 9,428		F(13,470) = 52,393		F(14,469) = 50,469		F(15,468) = 46,498		F(15,467) = 56,097	
Prob > F	0.000		0.000		0.000		0.000		0.000	
Adjusted R ²	0.148		0.510		0.523		0.522		0.579	
R ²	0.165		0.523		0.537		0.537		0.593	
Delta R ²			0.358		0.014		0.000		0.056	

Note: [#] robust standard errors.

fear of future unavailability is statistically significant and has a similarly high effect as “attitude” and “subjective norm.” Overall, the results suggest that perceived scarcity is more useful for understanding stockpiling behavior during the onset of the pandemic than perceived control. In conclusion, our data supports [Hypothesis 6](#).

3.2. Qualitative analysis results

[Table 5](#) displays the top five stated rationales (categories) for stockpiling and not stockpiling. For stockpiling the top categories “uncertain situation” entails participants’ statements referring to their insecurity, fear, worry, or their feeling of losing control. Also, the aim to reduce shopping frequency was frequently named as a reason for stockpiling nonperishable food. Some respondents also named a lack of possibility to eat outside as a reason for stockpiling nonperishable foods, indicating a change in place for food intake. Key stated rationale for not stockpiling was participants’ evaluation of stockpiling as being unnecessary, and that they had no fear of food shortages.

4. Discussion

When contrasting our qualitative and quantitative results, we found that many answers to the open question validated our results from the quantitative analysis (see the last column of [Table 5](#)). Some categories can be directly associated with our hypotheses and quantitative results. For instance, one main aspect for stockpiling or not stockpiling was the assessment of future availability of food (see also [Hypothesis 6](#)). Other categories and results are similar to our quantitative results, albeit not identical. For instance, the top-stated category for stockpiling was that participants considered the future situation uncertain. This recalls “perceived control” in the TPB ([Hypothesis 4](#)), though in the case of the qualitative data, future expectations were more important than actual control at the time. Interestingly, participants’ answers also did not specifically refer to uncertainty about the food supply, but rather to an overall uncertainty. Furthermore, many reasons/categories for not

stockpiling entail a negative judgement of stockpiling, which is similar to the concept of attitude within the TPB ([Hypothesis 3](#)). In addition to validating our results, we also gained completely new insights from the qualitative data. For instance, we found that reducing shopping frequency is stated to be a key reason for stockpiling.

When comparing our results with prior empirical evidence, we find that many results are as expected: Our results indicate intentions to stockpile explain a large part of the actual behavior. As the relationship between intention and behavior has been studied many times before (for examples, see [Fishbein & Ajzen, 2011](#)), this is not surprising. Also, our results are similar to prior evidence on the effect of attitude and subjective norm on intentions with regard to food consumption behavior (e.g., [McKee et al., 2019](#)). Moreover, our finding concerning the influence of the fear of future availability on stockpiling behavior is in line with research suggesting that perceived scarcity is a main driver of hoarding in general ([Byun & Sternquist, 2008](#); [Gupta & Gentry, 2019](#)), and specifically during COVID-19 ([Benker, 2020](#)). Our qualitative results further support that stockpiling is viewed by some as selfish and individualistic behavior (see also [Benker, 2020](#)) and going out less is a key motivator for stockpiling ([Wang, An, Gao, Kiprop, & Geng, 2020](#)). With regard to our results concerning the influence of neuroticism on stockpiling intentions, our results are a little bit more complex. On the one hand, we find that higher scores of neuroticism correlated to stockpiling intentions, which is similar to evidence from [Dammeyer \(2020\)](#). On the other hand, we find that controlling for socio-economic variables as well as TPB-related constructs, led to the effect of neuroticism on stockpiling intentions being very low and not statistically significant. In contrast to typical findings on food related behavior (e.g., [McKee et al., 2019](#)), our analysis results suggest a negative effect of perceived control on intentions.

A first limitation of our study is that we asked participants about intentions and behavior that lie in the past, thus taking a reconstructive approach. Also, [Fishbein and Ajzen \(2011\)](#) suggest to use a pilot study to identify relevant items for the measurement of TPB-related constructs. However, the psychometric properties of our scales provide confidence

Table 5
Results of the qualitative data analysis.

Category	Explanation	Examples	Freq	Contrasting with quantitative analysis
<i>Stockpiling behavior, n = 208 (multiple answers possible)</i>				
1. Uncertain situation	Expressing uncertain situation, insecurity, fear, worry, losing control	"Because I reckoned with everything, because nothing seemed certain any more..." (34) "Fear" (201) "Because it was unknown how the situation in the country was developing and the people did not know whether they were allowed outside or not" (78)	62	Similar to "perceived control" (Hypothesis 4), though people instead expressed fear of losing control in <i>future</i>
2. Reduction of shopping frequency	In order to go shopping less frequently (due to reasons like reducing contact with people, belonging to high risk group, wearing of masks)	"Because I wanted to go shopping less often, so that I wouldn't get infected (161)."	48	Not considered in the quantitative analysis, i.e., completely new insight
3. Fear of food shortage	Uncertainty or fear of food shortage in the future due to others' hoarding, closed shops, or experience of sold out products	"Because I felt put on the spot by others: since others hoard I don't know if there is still enough for me." (260) "To have enough food at home when stores should be closed due to coronavirus" (20)	45	Congruent with "fear of future unavailability" (Hypothesis 6)
4. Group dynamic	Expressing that they let themselves be dragged along by the behavior of others	"I can't say. Herd behavior." (10) "Somehow I let myself get infected..."	6	Similar to "subjective norm" (Hypothesis 2)
5. No restaurants	People stated they bought more than usual because they could not eat out	"No visits to restaurants" (54)	4	Not considered in the quantitative analysis, i.e., completely new insight
<i>Not stockpiling, n = 303 (multiple answers possible)</i>				
1. Unnecessary	Stockpiling is considered unnecessary; no reason for stockpiling; the situation is considered to be not so bad	"There was no reason for this" (117) "Because I saw no sense in it..." (283)	102	Similar to aspect "attitude" (Hypothesis 3), because it entails a judgement. Also related to "perceived control" since it assumes perceived full control over behavior at hand
2. No fear of food shortage	Trust into the future availability of food/groceries is expressed; shops will be open; supply chain and logistics not endangered	"I trust that there is always enough food to buy" (67) "Because the stores were allowed to stay open, after politicians' speeches, I did not buy more..." (223)	60	Congruent with "fear of future unavailability" (Hypothesis 6), the opposite of "fear of food shortage"
3. Stockpiling anyway	Stockpiling behavior is always exhibited; hence no more food than usual has been bought	"We have always had a certain basis of food to avoid having to shop all the time" (31)	33	Included as control variable "past stockpiling of nonperishable food"
4. Altruism	Expressions of concerns for others as reason for not stockpiling; stockpiling is explicitly considered antisocial, egoistic, unethical	"I did not want there to be not enough for other people." (222) "Immoral. And I find it selfish to stockpile"	10	Similar to "attitude" (Hypothesis 3), as it entails a judgement
5. Nonsense	Devaluating remarks about stockpiling	"I have not, total BS" (64) "Because I'm not stupid" (61)	10	Similar to "attitude" (Hypothesis 3)

in our operationalization. While we used a quoted sample, results still cannot be considered as representative and thus, generalizations from our sample to the population of Germany are inadequate. Concerning the robustness of our statistical analysis results, there are two limitations to be noted: First, we assume, alongside many other scholars, that multiple linear regression is an adequate approach to analyze TBP-related Likert data (Sok, Borges, Schmidt, & Ajzen, 2020). However, other scholars argue that Likert data is ordinal, indicating that parametric analyses are not appropriate (for a discussion see e.g., Norman, 2010). Secondly, we find that the regression residuals are not normally distributed. Scholars argue that with moderate to large sample sizes inferences about coefficients are relatively robust, even when the normality assumption is not met (Ernst & Albers, 2017; Williams et al., 2013), and our sample size may be deemed as such. Overall, there is the possibility that some error may have been introduced by using our analysis process for the collected Likert data.

5. Conclusion

At the onset of the coronavirus pandemic, sales of nonperishable food drastically increased. The aim of this study was to identify the reasons for this behavior. To do so, we analyzed qualitative and quantitative data collected from consumers in Germany. For the quantitative analysis, we extended the theory of planned behavior and found that

positive judgement of stockpiling (attitude), positive normative expectations of stockpiling (subjective norm) and the fear of not being able to obtain food in the future (fear of future unavailability) fostered the stockpiling of nonperishable foods at the onset of COVID-19. Our qualitative findings resulting from the analysis of open questions validated some of our quantitative findings, but also delivered new insights. For instance, a key stated reason for stockpiling nonperishable food was to reduce shopping frequency to decrease the chances of becoming infected or to avoid wearing uncomfortable masks.

Important questions about stockpiling foods in crisis situations remain open, and we hope that our research stimulates future work on this topic. First, we find that a substantial part of participants bought nonperishable food more than usual. While this finding may suggest that consumption patterns, in terms of which food was consumed on a daily basis, also changed, it does not necessarily mean this. It may be possible that nonperishable food was not more consumed than usual as, for instance, typical meals which were previously eaten in restaurants or canteens (e.g., pasta) were now cooked at home. Future research may find answers to these type of questions related to the change of food intake during COVID-19. Another starting point for research is that "group dynamic" is one of the top five stated reasons for stockpiling. Here, we suggest that the role that sensationalist headlines and reporting about panic buying play should be investigated. Overall, future research (e.g., replication studies) may identify whether our key findings are

generalizable, for instance, to further stages within pandemic, and/or if attitudes towards stockpiling nonperishable food or the fear of future availability considerably changed during the pandemic. Regarding the practical implications of the study, our findings suggest practitioners should identify strategies to mitigate consumers' fear of unavailability of nonperishable food to avoid excessive stockpiling of nonperishable food in future crises.

Ethical statement

The authors declare that the online study received ethical approval from German Association for Experimental Economic Research e.V. (Certificate No. ckVDWfPA).

Appendix. Newly constructed questionnaire items related to the TPB and descriptive statistics

Nr.	Wording of questions/statements (translated from German)	Construct	Type of scale and coding	Mean	SD	
1	I purchased, on average, about what % more nonperishable food (e.g., pasta, flour, canned food) than normal during the first two weeks of the contact ban due to coronavirus (March 23 to April 6)? (For example, and to explain: 0% = you have not bought more than normal; 100% = you have bought twice as much as normal; 1000% = you have bought ten times as much as normal)	n/a	Continuous	23.2	72.0	
2	For what reasons did you purchase more than normal nonperishable food, or if you did not purchase more than normal, why not?	n/a	Open question	n/a		
3	I found buying more (than normal) nonperishable food during the first two weeks of the no-contact period	Attitude	Semantic differential bad (=1) - good (=7)	59.4	10.7	29.9
4	(March 23 to April 6) due to coronavirus: good -bad	Attitude	disadvantageous (=1) – advantageous (=7)	50.8	11.7	37.5
5	social - antisocial	Attitude	antisocial (=1) – social (=7)	64.1	15.8	20.1
6	useful -useless	Attitude	useless (=1) - useful (=7)	59.0	9.0	32.0
	How much do the following statements apply to the period during the first two weeks of the lockdown due to coronavirus (March 23 to April 06)?		Likert-typed scale Do not agree at all (=1) to agree completely (=7)			
7	Most of the people I care about thought I should buy more nonperishable food than normal.	Subjective norm		54.7	22.7	22.5
8	Most people whose opinions matter to me have/had approved of me buying more nonperishable food than normal.	Subjective norm		53.5	24.2	21.9
9	Most people who are like me have bought more nonperishable food than normal.	Subjective norm		47.7	24.6	27.7
10	Most people similar to me have bought more nonperishable food than normal.	Subjective norm		48.8	23.5	27.8
11	Whether or not I bought more nonperishable food than normal was entirely up to me.	Perceived control		15.4	17.8	66.8
12	I myself was in control of whether or not I bought more nonperishable food than normal.	Perceived control		10.5	16.6	73.0
13	How many nonperishable foods I bought I determined on my own.	Perceived control		11.1	16.2	72.7
14	I was worried that I would not be able to buy enough nonperishable food in the future.	Fear of future unavailability		59.6	19.5	20.9
15	In the supermarkets where I shopped, there were no quantity limits on the purchase of nonperishable food.	Actual control		38.3	26.2	35.5
16	In the supermarkets where I shopped, all nonperishable foods were always available for purchase.	Actual control		51.8	19.7	28.5
17	I bought a lot of nonperishable food even before the Corona crisis.	Past stockpiling		44.5	25.4	30.1
18	After the Corona crisis, I will buy more nonperishable food than before the crisis.	Future Intention*		68.0	18.2	13.7
19	I have the intention to buy more nonperishable food after the corona crisis than before the crisis.	Future Intention*		68.6	18.0	13.3
20	During the first two weeks of the lockdown due to the coronavirus (March 23 to April 6), I had the intention to buy more nonperishable food than normal.	Intention		57.6	19.5	23.0
21	During the first two weeks of the lockdown due to the coronavirus (March 23 to April 6), I deliberately had the aim to buy more nonperishable food than normal.	Intention		59.4	18.2	22.3
22	During the first two weeks of the lockdown due to the coronavirus (March 23 to April 6), I bought more nonperishable food than normal	Behavior		57.0	19.7	23.4

Note*: not included in the analysis.

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