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# A study of the impact of the COVID-19 pandemic on the food purchasing behavior of residents in Hubei, China

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## 1. Introduction

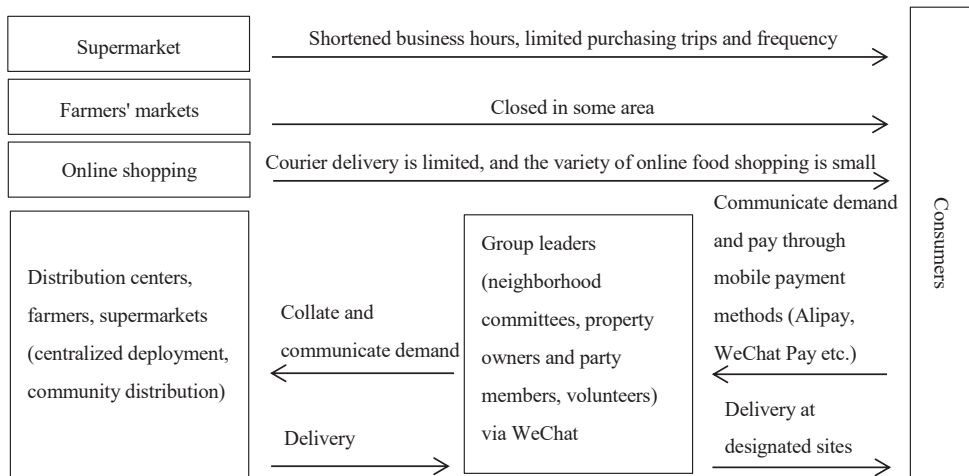
The general consensus is that the 2019 Novel Coronavirus Disease (COVID-19) emerged in Wuhan, Hubei Province, China, rapidly spread throughout China and worldwide since December 2019. Over the past two years, the cumulative number of infections in 216 countries and territories was over 279 million with up to 5 million fatalities (WHO, 2022). The global COVID-19 pandemic has considerably threatened the health and daily lives of people worldwide. Taking China as an example, to prevent the spread of COVID-19, local Chinese governments have taken several measures, such as lockdown of cities, villages, and communities (*XiaoQu*); controlling the movement of vehicles and people; as well as suspending work and schooling. Supermarkets tend to shorten their operating hours, while restaurants tend to suspend operations or ban dine-in food services. These measures have had an evident impact on residents' food-purchasing behaviors.

During the COVID-19 pandemic, Chinese governments and communities have directed that each household should not go out more than 1–2 times a day to purchase food and unless necessary. In addition, people were required to wear masks, their body temperature was checked, and fill out and present a State Department Epidemic Prevention Big Data trip card. In this case, the main food purchasing channel shifted from supermarket and farmers' markets to “community distribution” (Figure 1). “Community distribution” implies an emergency measure that is undertaken by the government to supply household goods directly to communities, regardless of the size of the community and its needs. The

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Source: Self-drawn by the authors

Figure 1. China-specific patterns of changes in consumer food purchase pathways during the COVID-19 pandemic.

group leaders of each community, comprising staff from the street office, party members, and volunteers, are responsible for collating and registering the community residents' needs regarding household goods; liaising with bulk food wholesale markets, farmers markets, and supermarkets to make purchases; and delivering the goods to residents at designated sites. This particular emergency supply chain model is unique and globally uncommon, and is closely linked to China's political system as well as to the widespread use of mobile payment methods, such as Alipay and WeChat Pay, in China.

## 2. Literature review and research purpose

### 1) Literature review

Consumption behavior is an important issue that has received considerable academic attention. Li (2018) and Lu (2021) used microdata to analyze the factors that influence consumption behavior, such as age, income, price, education level, household size, and policy. However, there is scant literature on the change in consumption behavior and its

influencing factors in face of the “black swan events”<sup>1)</sup>, the typical studies are those on severe acute respiratory syndrome (SARS) in 2003 and the Great East Japan Earthquake on March 11, 2011 (the 3.11 earthquake).

Based on an analysis of the literature on the black swan event, studies on the impact of SARS on consumer behavior in 2003 concluded that the epidemic caused consumers to go out less and their willingness to consume decreased. This resulted in a significant decrease in the consumption of food and beverages, transportation, as well as culture and entertainment. Tao (2003), Li (2003), and Li and Sun (2006) proposed that the causes of consumption volatility are mainly due to consumer fear, consumer demand for security, changes in psychological expectations, and the psychology of speed, convenience, and herd mentality. Fan (2003) and Zhang, Zu, and Xu (2014) reported that in the face of black swan events, people prefer to bank their disposable income, while consumption demand decreases, consumption structure changes, and e-commerce is promoted because it prevents direct interpersonal contact.

Yamamoto, Oura, and Morio (2012) examined the impact of the 3.11 earthquake in Japan in 2011 on consumer behavior and concluded that within a week of this earthquake, the amount of food purchased and stored by consumers increased significantly, and there was a shortage of supply in the market. Bulk food purchases are dominated by easily storable commodities, such as mineral water, instant noodles, bread, canned goods, and rice. Such behavior is influenced by various factors, such as household food stocks, life safety and security, anxiety about insufficient stocks of commodities, household size, annual income, and age.

Ujiié (2011) and Hanguí (2012) conducted research on the consumption of agricultural and livestock products from radioactively contaminated areas and suggested that consumers would make a risk assessment and decide on their own willingness and purchasing behavior, and that there was a clear tendency for consumers to avoid purchasing products from these areas. However, when there is a moderate price reduction for these products, some consumers will choose to purchase them. In addition, consumers with the idea of supporting the recovery of contaminated areas, such as Fukushima Prefecture, buy products from these areas, albeit in very limited quantities. In contrast,

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<sup>1</sup> Black swan events: A black swan is an unpredictable event that is beyond what is normally expected of a situation and has potentially severe consequences. Black swan events are characterized by their extreme rarity, severe impact, and the widespread insistence that they had been obvious in hindsight.

Hiromasa, Nakajima, and Takekoshi (2012) and Hiromasa and Ogawa (2015) proposed that the distrust of the administration, the insecurity of unknown risks, and the possible health effects on children influence the decision-making of consumers to purchase agricultural and livestock products from radioactively contaminated areas.

In Liu and Zhang's (2020) study the impact of the COVID-19 pandemic on consumer behavior in 2019, they found that the epidemic prompted a rapid awakening of consumer awareness of safety and health, the full development of online lifestyle habits, increasingly strong spiritual and cultural needs, a decline in the willingness to spend, a downturn in the end-market consumption, and a decline in the consumption capacity of some groups. Guan (2020) forecasted changes in consumer development trends during the pandemic and believed that the online and offline consumer market will be deeply integrated, rational consumption will become mainstream, and overseas consumption will return to China. John (2020) suggested that the COVID-19 pandemic will have an impact on consumers' food demand, largely due to income and time constraints, as well as price fluctuations.

Throughout the review of literature on the study of food consumption behavior in the face of serious public emergencies, most studies focus on the impact on consumption or on the consumption psychology and habits of residents. First, most literature focuses on the changes in consumers' consumption intentions, and there are few studies on the changes in food distribution channels. Second, most literature considers changes in the overall consumption trend of society after the emergency, and there are few studies on urban–rural and individual differences.

## **2) Research purpose**

Based on extant literature, this paper focuses on the changes in consumer consumption channels as well as urban–rural and individual differences during the COVID-19 pandemic. First, we collect data on changes in the food purchasing behavior of urban and rural consumers in Hubei before and during the pandemic via a questionnaire survey. Thereafter, we analyze the changes in food purchase channels, food purchase frequency, and purchase quantity of consumers with different characteristics under a serious public emergency to provide a reference for the government or the food supply side on how to ensure the stability of residents' lives, as well as adjust the quantity of food supply and the distribution method in the face of a serious public emergency.

### 3. Analytical framework and data

#### 1) Analytical framework

Owing to the epidemic prevention policies and measures, residents were restricted from going out to shop. It is presumed that consumers increase the amount of food purchases per purchase to obtain the food necessary for survival and subsistence. Conversely, this shortens shopping time per purchase, further increases shopping efficiency, and shifts from offline to online shopping under the influence of serious public emergencies. The reduction in shopping time means that consumers cannot select goods leisurely and must make judgments in a short time, and food purchase efficiency increases.

In this study, we use basic statistical methods to describe the changes in consumers' food purchasing behavior before and during the COVID-19 pandemic. Thereafter, the binary logit model is applied to analyze the key factors influencing food purchasing behavior in the face of the pandemic.

The binary logit model can be described as follows:

$$Pi(Y_i) = f(\beta_0 + \sum_{j=1}^m \beta_j X_{ij}) = \frac{1}{1 + \exp(-\beta_0 + \sum_{j=1}^m \beta_j X_{ij})} + \varepsilon_i$$

where  $Y_i$  is the dependent variable and assumes two values of 0 or 1, that is,  $Y_i = 1$  if  $Y_i^* > 0$ ; otherwise,  $Y_i = 0$ .  $Pi$  is the probability of the occurrence of one event,  $\beta_0$  is the intercept,  $\beta_j$  is the regression coefficient,  $X_{ij}$  are the independent variables,  $\varepsilon_i$  is the error term, and  $i$  represents the individual respondent.

In the next section, we estimate the following two regression models: Model 1 ( $Y_1$ ) is the case whereby the amount of food purchased per purchase increases during the pandemic compared with before, while Model 2 ( $Y_2$ ) is the case in which the purchasing time per purchase is shorter during the COVID-19 pandemic compared with before. Thus,  $Y_{1i} = 1$  if the amount of food purchased per purchase increases; otherwise,  $Y_{1i} = 0$ . In addition,  $Y_{2i} = 1$  if the purchasing time shortens; otherwise,  $Y_{2i} = 0$ .

Individual consumer characteristics and variables with high and representative correlations with the pandemic were selected as explanatory variables. In Models 1 and 2, the dependent variables were  $X_1$ : gender,  $X_2$ : age,  $X_3$ : education,  $X_4$ : household size,  $X_5$ : annual household income,  $X_6$ : whether there were confirmed or suspected cases in their

neighborhood,  $X_7$ : frequency of food purchase before the pandemic,  $X_8$ : whether living in Wuhan city, and  $X_9$ : urban and rural areas. As the elasticity of demand for food is low and consumers' demand is relatively stable,  $X_{10}$ : whether the frequency of purchases during the pandemic decreased was added to Model 2 to account for the changes in food consumption psychology and behavior, such as whether consumers become rushed and do not have sufficient time to make a selection during the pandemic.

Based on the results of previous studies and the purpose of this study, we designed a questionnaire to investigate the demographic characteristics of residential households, the amount of food purchases per purchase, time per purchase, and other indicators reflecting changes in consumers' food purchasing behaviors before and during the COVID-19 pandemic.

## 2) Data

Data on consumers' food purchasing behavior in Hubei province were collected from users registered with the Tencent Questionnaire application. The survey was conducted from March 23, 2020, to March 29, 2020. A total of 405 questionnaires were distributed among the counties and cities in Hubei Province, mainly in Wuhan City, with a 100% response rate. The responses of participants who were not in Hubei Province at the time of answering the questionnaire and those who answered the question for less than three minutes were excluded. Thus, a total of 352 valid questionnaires were received, with a validity rate of 86.91%. An overview of our survey and the descriptive statistics of the independent variables are shown in Tables 1 and 2.

Table 1. Survey overview.

Investigating period	2020.3.23 to 2020.3.29
Respondents	Consumers living in Hubei Province during the COVID-19
Number of questionnaires distributed	405
Number of valid questionnaires	352
Questionnaire effectiveness	86.91%

Source: Authors' survey 2020

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Table 2. Descriptive statistics.

Variable	Contents	Mean
Dependent variables		
Whether the amount of each purchase increases during the COVID-19 pandemic compared with before	yes=1; no=0	0.796
Whether the time per purchase is shorter during the COVID-19 pandemic compared with before	yes=1; no=0	0.767
Independent variables		
Gender	male=0; female=1	0.676
Age	≤18=1; 18~25=2; 26~35=3; 36~45=4; 46~55=5; ≥56=6	2.86
Education level	Education years ≤6=1; 6~9=2; 10~12=3; 13~16=4; ≥17=5	3.722
Household size	Population	3.761
Annual household income (thousand yuan)	≤30=1; 30~60=2; 60~120=3; 120~200=4; 200~300=5; ≥300=6	2.605
Whether there were confirmed or suspected cases in your neighborhood	yes=1; no=0	0.397
Frequency of food purchase before the COVID-19 pandemic	Once every 3 weeks or less=1; Once every 3 weeks=2; Once or twice a week=3; Three or four times a week=4; Five or six times a week=5; Once a day=6; More than twice a day=7	4.358
Whether living in Wuhan city	yes=1; no=0	0.338
Urban or rural resident	urban=1; rural=0	0.724
Whether the frequency of purchases during the COVID-19 pandemic decreased	yes=1; no=0	0.867

Source: Authors' survey 2020

## 4. Analysis of the impact of the COVID-19 pandemic on food purchasing behavior

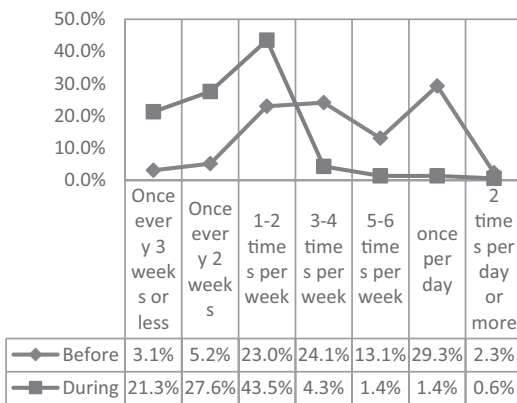
### 1) Descriptive analysis

#### 1.1 Survey on changes in food purchases behavior before and during the pandemic

COVID-19 pandemic has significantly affected consumers' food purchasing behavior and habits. Taking the city closure of Wuhan, Hubei Province, on January 23, 2020, as the time point, we divided the period as before and during the COVID-19 pandemic. As shown in Figures 2–4, in terms of the frequency of food purchases, the proportion of consumers who

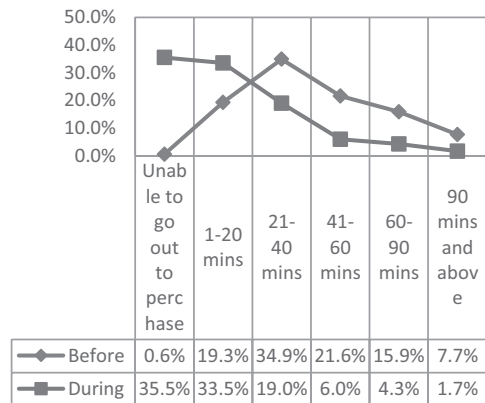


purchased food more than three times a week decreased from 68.8% before COVID-19 to 7.7% during the pandemic. Approximately half of the consumers purchased food less than once every two weeks during the pandemic. In terms of time spent per food purchase, the percentage of consumers who spent more than 20 minutes per purchase decreased from 80.1% before COVID-19 to 31% during the pandemic. Moreover, 35.5% of consumers were unable to go out to buy food. In terms of the amount spent per food purchase, the percentage of consumers who spent less than 150 yuan per food purchase decreased from 84.7% before COVID-19 to 38.9% during the pandemic. This shows that this pandemic has a serious impact on the normal lives of residents.



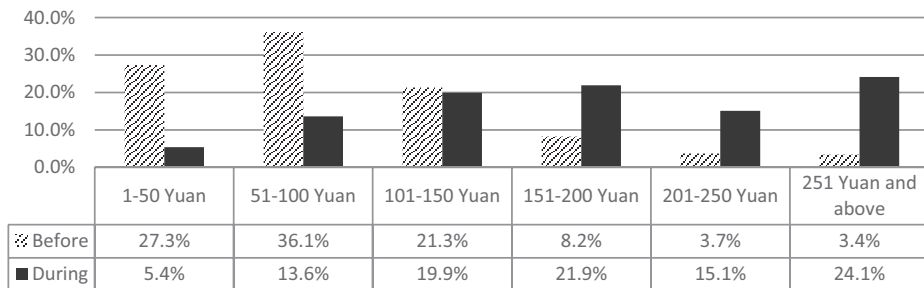
Source: Author's survey 2020

Figure 2: Percentage changes of food purchases at various frequencies before and during the COVID-19 pandemic (%).



Source: Author's survey 2020

Figure 3: Percentage change in time spent per purchase varies by gradient before and during the COVID-19 pandemic (%).



Source: Authors' survey 2020

Figure 4: Percentage change in the amount spent per purchase of food varies by gradient before and during the COVID-19 pandemic.

Overall, during the pandemic, there was a decrease in the frequency of food purchases, a decrease in time spent per purchase, and an increase in the amount of money spent on food per purchase.

### **1.2 Survey of food purchases through online shopping and take-out during the pandemic**

As shown in Table 3, the main food procurement methods and places of consumers affected by the C pandemic have changed from supermarkets and farmers' markets before the outbreak to WeChat platforms, such as WeChat groups of local merchants and local mutual support WeChat groups, as well as community distribution.

As shown in Table 4, based on the effect of the pandemic, the number of respondents who eat at home almost every day rose from 43.2% before COVID-19 to 92.3% during the pandemic; the proportion of respondents who regularly order takeaways and eat out decreased significantly. Owing to measures such as the city closure policy and the adjustment of business hours of traditional retail businesses, food purchasing pathways have changed.

In terms of online food purchases, the main objects of such purchases are vegetables, fruits, meat, snacks, and fast food during the COVID-19 pandemic. The main traditional online shopping platforms that have been used by Hubei residents during the COVID-19 pandemic are Taobao (20.2%), JD.com (15.3%), and Tmall (10.5%). The utilization rates of online platforms for local merchants are, respectively, local WeChat mutual support groups (53.4%), WeChat to place orders with local merchants (42.6%) and community distribution (52.3%).

However, during the COVID-19 pandemic, the utilization of Hubei consumers' takeaways ordered online using traditional delivery platforms, such as Meituan and Eleme, is only 20.7%. While 31.8% of consumers choose to use local WeChat support groups to order takeaway, 30.1% use WeChat to place orders with local merchants, and 33.2% use community delivery.

Overall, the proportion of consumers purchasing food and meals through online shopping and takeaway declined during the pandemic compared to the pre-epidemic period, while the main online shopping platforms used shifted from national shopping platforms to local shopping platforms and local mutual support groups.

Table 3. Percentage of people using different food purchasing methods and places before and during the COVID-19pandemic (%).

		Extremely low utilization rate (0-25%)	Low utilization rate (26%-50%)	High utilization rate (51%-75%)	Extremely High utilization rate (75%-100%)	Chi-square value
Supermarket	Before	15.3	34.7	31.3	18.8	131.3***
	During	52.8	14.2	12.5	20.5	
Farmers' market	Before	24.4	38.9	23.9	12.8	317.7***
	During	90.3	5.7	0.6	3.4	
Online shopping	Before	58.2	26.4	11.6	3.7	41.8***
	During	55.7	18.2	8.0	18.2	
WeChat	Before	78.4	13.1	5.7	2.8	105.5***
	During	44.0	18.8	14.5	22.7	
Community distribution	Before	89.5	4.3	2.6	3.7	157.7***
	During	45.2	17.9	13.4	23.6	

Source: Authors' survey 2020

\*\*\*, \*\*, and \* represent a significance level of the estimated non-zero coefficient of 1%, 5%, and 10%, respectively.

Online shopping: Taobao, JD.com, etc.

WeChat: Place orders for local merchants' products via WeChat; local mutual support WeChat groups

Table 4. Percentage of persons utilizing each dining venue before and during the COVID-19 pandemic (%).

		Extremely low utilization rate (0-25%)	Low utilization rate (26%-50%)	High utilization rate (51%-75%)	Extremely High utilization rate (75%-100%)	Chi-square value
Eat at home	Before	11.6	17.9	27.3	43.2	201.0***
	During	5.1	0.6	2.6	92.3	
Order food delivery	Before	83.0	9.9	4.8	2.3	37.9***
	During	95.5	1.7	0.3	2.6	
Eat out	Before	65.9	23.3	8.2	2.6	115.7***
	During	97.2	1.4	0.6	0.9	

Source: Authors' survey 2020

\*\*\*, \*\*, and \* represent a significance level of the estimated non-zero coefficient of 1%, 5%, and 10%, respectively.

### **1.3 Survey on the impact of the COVID-19 pandemic on consumers' lives**

A survey on the perceptions of food sufficiency in the market during the COVID-19 pandemic shows that 10.8% of respondents considered that there was an acute shortage of food in the market, while 51.7% considered that there had been a temporary shortage. A total of 18.5%, 16.8%, and 2.3% of respondents considered the level of adequacy to be average, relatively adequate, and very adequate, respectively.

There was also a food rush and stockpiling in the food market during the COVID-19 pandemic. Of the respondents, 68.5% said that they had participated in a food rush or stocked up on food. The main reasons for this were, in descending order, single bulk purchases to reduce the rate of going out (68.8%), panic due to the lack of food in the market (35.2%), and the influence of network messages (22.4%). Respondents said that during the pandemic there was a rush to buy staple foods, such as rice and flour, instant foods, such as instant noodles and ham sausage, as well as meat, eggs, milk, fruits, and vegetables.

Respondents' concerns about food safety have also changed during the. Of the respondents, 62.2% said that they were more concerned about food safety, 50.9% stated that they were more concerned about the shelf life of food, and 21.3% stated that they were more concerned about the origin and producer of the food.

In terms of the convenience of food purchases, the reduction or suspension of the operating hours in various food vendors inconvenienced consumers. During the COVID-19 pandemic, residents were also unable to leave their homes and enter supermarkets, thereby disrupting food consumption. Meanwhile, online shopping was also restricted based on logistics. Some respondents said they could not shop online during the pandemic and could only place orders with local merchants, which takes longer and is less convenient and time-sensitive. In terms of distribution, to prevent the spread of COVID-19, there were relatively few businesses offering home delivery services, and most required residents to line up at the front of their neighbors to pick up their goods.

In terms of food diversity and prices, the variety of food available in the market decreased during the pandemic. There were a few types of vegetables and fruits, as well as a relative lack of meat, eggs, and milk due to the city-closing policy. The overall prices of fruits, vegetables, and meat have risen.

In addition, residents who use community distribution services can only purchase matching fruit, vegetable, and meat packages that are more restrictive. In terms of food quality, there is a problem with the low freshness of food. It is difficult to buy fresh fruits and vegetables, and seafood and meat are mostly frozen.

Overall, although there were certain food purchasing-related problems, such as relatively inadequate food supply, untimely food allocation, low convenience, poor timeliness, low freshness, high prices, and few selective types, during the pandemic, most respondents indicated that community delivery volunteers and local mutual support WeChat groups delivered food during the pandemic, and this was convenient and helpful to their food purchases.

## **2) Analysis of factors influencing changes in consumers' food purchasing behavior before and during the COVID-19 pandemic**

The estimation results of the two binary logit models described in Section 3.1 are shown in Table 5. Given the chi-square value, the value of Nagelkerke's  $R^2$ , and the log-likelihood of -2 in Table 5, the null hypothesis of each model, which holds that all the regression coefficients could not be zero at the same time, the model could fit the data of the total samples, and independent variables could better explain the dependent variables, is rejected.

The independent variable  $X_1$  (Gender) has a significant positive effect on the reduction of time spent per purchase during the COVID-19 pandemic. Compared to male respondents, there was a more significant reduction in the time spent per purchase of food among female respondents during the pandemic.

The independent variable  $X_2$  (Age) has a significant positive effect on the reduction of time spent per purchase by respondents during the COVID-19 pandemic. The older the respondents are, the stronger their fear of the epidemic and their awareness of being well protected against the epidemic, and the more likely they are to shorten the time spent per purchase.

The independent variable  $X_3$  (Education) has a significant positive effect on the increase in the amount of money spent per purchase during the pandemic. The higher the education level of the respondents, the higher their income level and awareness of stocking up on food, reducing going out, and taking precautions against the epidemic, the more

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significant their tendency to increase the amount spent per purchase during the pandemic. The lower the education level of respondents, the lower their discretionary income, which limits the amount of food they can purchase.

Table 5. The results of the regression analysis.

Dependent variables	Model 1		Model 2	
	Coefficient	Standard error	Coefficient	Standard error
Whether the amount of each purchase increases during the COVID-19 pandemic compared with before (Y <sub>1</sub> )			Whether the purchasing time per purchase is shorter during the COVID-19 pandemic compared with before (Y <sub>2</sub> )	
X <sub>1</sub> (Gender)	-0.045	0.300	0.882***	0.289
X <sub>2</sub> (Age)	-0.053	0.141	0.502***	0.148
X <sub>3</sub> (Education level)	0.495**	0.204	-0.023	0.220
X <sub>4</sub> (Household size)	0.059	0.154	0.072	0.145
X <sub>5</sub> (Annual household income)	-0.106	0.129	0.030	0.122
X <sub>6</sub> (Whether there were confirmed or suspected cases in your neighborhood)	-0.274	0.336	0.058	0.321
X <sub>7</sub> (Frequency of food purchase before the COVID-19 pandemic)	0.360***	0.105	-0.642***	0.160
X <sub>8</sub> (Whether living in Wuhan city)	0.328	0.359	-0.519	0.329
X <sub>9</sub> (Urban or rural resident)	0.798**	0.365	0.528	0.359
X <sub>10</sub> (Whether the frequency of purchases during the COVID-19 pandemic decreased)			0.702***	0.176
Constant	-2.241**	1.130	0.232	1.136
Chi-square value	32.272		41.640	
Nagelkerke's R <sup>2</sup>	0.138		0.168	
Log-likelihood of -2	324.402		342.874	

Source: Authors' survey 2020

\*\*\*, \*\*, and \* represent a significance level of the estimated non-zero coefficient of 1%, 5%, and 10% respectively.

The independent variable  $X_7$  (Frequency of food purchases before the COVID-19 pandemic) has a significant positive impact on the increase in the purchase amount of food and a significant negative effect on the decrease in time spent per purchase during the pandemic. These results are consistent with findings that residents who usually buy food in local supermarkets or farmers' markets before the pandemic have limited access to food purchases during the pandemic and have to shift their purchases from supermarkets or markets to online food purchases or community delivery of food purchases. There were also upward fluctuations in food prices during the pandemic.

The independent variable  $X_9$  (Urban or rural areas) has a significant positive effect on the increase in the amount of each purchase during the pandemic. Compared with rural residents, urban residents are more likely to increase the amount of each purchase during the pandemic, which may be related to the source of food for urban and rural residents. In China, rural residents mainly rely on fruits and vegetables from their own gardens during this period, and do not need to go out to purchase food frequently; thus, it generally appears that the epidemic has a reduced impact on rural residents' food purchases. Conversely, urban residents were affected by the restrictions on going out during this period, so the number of food purchases decreased and the amount of food purchased per purchase increased significantly<sup>2</sup>).

The independent variable  $X_{10}$  (Whether the frequency of purchase decreases during the COVID-19 pandemic) has a significant positive effect on the reduction of time spent per purchase during this time. The reason for adopting  $X_{10}$  in Model 2 is, as mentioned in Section 3.1, to account for the changes in food consumption psychology and behavior during the pandemic. In that sense, this result seems to suggest that residents' psychology of not being infected with COVID-19 induces a reduction in the frequency of purchase and purchasing time spent per purchase.

## 5. Conclusions

In this study, we examine the impact of the COVID-19 pandemic on consumers' food purchasing behavior using micro-survey data and conducted in Hubei province, mainly

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<sup>2</sup> This is also confirmed by the supplementary telephone interview surveys conducted by the authors in August 2020 and September 2021 among urban and rural residents in Hubei Province, respectively.

Wuhan City. From the descriptive statistical analysis and binomial logit regression analysis, we report the following findings:

With descriptive statistical analysis of aggregated data, it was revealed that there was a decrease in the frequency of food purchases, a decrease in time spent per purchase, and an increase in the amount of money spent on food per purchase during the COVID-19 pandemic compared to before the pandemic.

Using binary logit regression analysis, we find that some personal character variables have a significant effect on residents' food-purchasing behavior. Females exhibit a more significant reduction in the time spent per purchase of food during the pandemic. Age also has a significant positive effect on the reduction of time spent per purchase, and education level has a significant positive effect on the increase in the amount of money spent per purchase during the pandemic. It became clear that there was a difference in food expenditure between urban and rural residents. This is mainly because many rural residents are self-sufficient in some vegetables and fruits. In addition, the frequency of food purchases before the pandemic has a significant positive (negative) impact on the increase (decrease) in purchase amount (time spent per purchase) during the COVID-19 pandemic. Whether the frequency of purchase decreases during the pandemic has a significant positive effect on the reduction in time spent per purchase during this period. It is generally recognized that the reduction of time per purchase is subjectively based on residents' fear of the epidemic and their increased awareness regarding protection, while objectively, residents are more likely to make irrational and quicker purchases due to the reduced food selectivity, increased food scarcity, and panic.

Finally, the COVID-19 pandemic has changed the manner and channels of food purchasing in Hubei Province. From the perspective of consumers, the main methods and places of food purchase have shifted from supermarkets and farmers' markets to online shopping and so on. The proportion of consumers purchasing food through online shopping and takeaway has decreased compared to before, while the main online shopping platforms used have shifted from national shopping platforms to local shopping platforms and local mutual support groups, such as WeChat groups organized by local merchants, WeChat mutual support groups, and the "community distribution" model. The "community distribution" model was recognized as a unique social innovation toward ensuring food transportation and marketing during this pandemic, but the background and actual situation of its establishment has not been clarified yet. And it was also unclear



whether the main reason for the reduction of time spent per purchase was the effect of going out restrictions or the risk aversion of consumers to avoid infection. These are our future research task.

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## Appendix

Survey on the impact of the COVID-19 pandemic on the food purchasing behavior of  
Hubei residents

Dear Madam/Sir

I am Yuxin Li, a first-year doctoral student in the Department of Agricultural Economics and Management at Tohoku University Graduate School of Agricultural Science. First, thank you very much for your support! Please be assured that the results of this survey will only be used for academic research and thesis publication, and not for other purposes. I look forward to your objective comments and answers to the following questions during your busy schedule. Thank you for your cooperation!

### I. Individual consumer characteristics

#### 1. Gender

A. Female B. Male

#### 2. Age

A. Under 18 years old B. 18–25 years old C. 26–35 years old D. 36–45 years old E. 46–55 years old  
F. 56 years old and above

#### 3. Education

A. Primary school B. Middle school C. High school D. College and university E. Master and above

#### 4. Number of family members (the number of permanent residents in the family during the COVID-19 pandemic)

A. One person B. Two people C. Three people D. Four people E. Five people and above

#### 5. Marital status

A. Unmarried B. Married

#### 6. Occupation

A. Company employee B. Civil servant C. Teacher D. Doctor E. Freelancer F. Student G. Retired  
H. Other

#### 7. Average annual household income (total household income of all permanent family member during the COVID-19 pandemic) (Yuan)

A. Below 30,000 B. 30,000–60,000 C. 60,000–12,000 D. 120,000–200,000 E. 200,000–300,000  
F. 300,000 and above

#### 8. The county and city where

A. Wuhan B. Huangshi C. Shiyan D. Jingzhou E. Yichang F. Xiangyang G. Ezhou H. Jingmen

I. Xiaogan J. Huanggang K. Xianning L. Suizhou M. Enshi Tujia and Miao Autonomous Prefecture

N. Xiantao O. Qianjiang P. Tianmen Q. Shennongjia Forestry District

9. Place of residence

A. City B. Countryside

II. Survey on consumers' food purchasing and eating habits before and during the COVID-19 pandemic

1. Frequency of food purchases before COVID-19

A. Once every three weeks or less B. 2 times every two weeks C. 1–2 times a week  
D. 3–4 times a week E. 5–6 times a week F. 1 time a day G. More than 2 times a day

2. Frequency of food purchases during the COVID-19 pandemic

A. Once every three weeks or less B. 2 times every two weeks C. 1–2 times a week  
D. 3–4 times a week E. 5–6 times a week F. 1 time a day G. More than 2 times a day

3. The amount of money spent on each food purchase before the COVID-19 pandemic

A. 1–50 yuan B. 51–100 yuan C. 101–150 yuan D. 151–200 yuan E. 201–250 yuan F. 251 yuan or more

4. The amount of money spent on each food purchase during the COVID-19 pandemic

A. 1–50 yuan B. 51–100 yuan C. 101–150 yuan D. 151–200 yuan E. 201–250 yuan F. 251 yuan or more

5. Time spent on each food purchase before the COVID-19 pandemic

A. Cannot go out shopping B. 1–20 minutes C. 21–40 minutes  
D. 41–60 minutes E. 60–90 minutes F. 90 minutes or more

6. Time spent on each food purchase during the COVID-19 pandemic

A. Cannot go out for shopping B. 1–20 minutes C. 21–40 minutes  
D. 41–60 minutes E. 60–90 minutes F. 90 minutes or more

7. The proportion of main dining places before the COVID-19 pandemic

(1) Eating at home

A. 0–25% B. 26–50% C. 51–75% D. 75–100% E. Other: \_\_\_\_%

(2) Eating at home by ordering food delivery

A. 0–25% B. 26–50% C. 51–75% D. 75–100% E. Other: \_\_\_\_%

(3) Eating out

A. 0–25% B. 26–50% C. 51–75% D. 75–100% E. Other: \_\_\_\_%

8. The proportion of main dining places during the COVID-19 pandemic

(1) Eating at home

A. 0–25% B. 26–50% C. 51–75% D. 75–100% E. Other: \_\_\_\_%

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(2) Eating at home by ordering food delivery

A. 0–25% B. 26–50% C. 51–75% D. 75–100% E. Other: \_\_\_\_%

(3) Eating out

A. 0–25% B. 26–50% C. 51–75% D. 75–100% E. Other: \_\_\_\_%

(4) What is the main reason for eating out during the COVID-19 pandemic? (not required question)

9. The proportion of major food procurement methods before the COVID-19 pandemic

(1) Supermarkets

A. 0–25% B. 26–50% C. 51–75% D. 75–100% E. Other: \_\_\_\_%

(2) Farmer's markets

A. 0–25% B. 26–50% C. 51–75% D. 75–100% E. Other: \_\_\_\_%

(3) Online shopping (Taobao, Jingdong Mall, etc.)

A. 0–25% B. 26–50% C. 51–75% D. 75–100% E. Other: \_\_\_\_%

(4) WeChat (Place orders with local merchants via WeChat, local mutual WeChat group, etc.)

A. 0–25% B. 26–50% C. 51–75% D. 75–100% E. Other: \_\_\_\_%

(5) Other ways to purchase agricultural products (not required question)

Procurement methods: \_\_\_\_\_.

Percentage: \_\_\_\_%

10. Proportion of major food procurement methods during the COVID-19 pandemic

(1) Supermarkets

A. 0–25% B. 26–50% C. 51–75% D. 75–100% E. Other: \_\_\_\_%

(2) Farmers' markets

A. 0–25% B. 26–50% C. 51–75% D. 75–100% E. Other: \_\_\_\_%

(3) Online shopping (including WeChat orders)

A. 0–25% B. 26–50% C. 51–75% D. 75–100% E. Other: \_\_\_\_%

(4) WeChat (Place orders with local merchants via WeChat, local mutual WeChat group, etc.)

A. 0–25% B. 26–50% C. 51–75% D. 75–100% E. Other: \_\_\_\_%

(5) Other ways to purchase agricultural products (not required question)

Procurement methods: \_\_\_\_\_.

Percentage: \_\_\_\_%

III. Survey on food purchased through online shopping and food delivery during the COVID-19 pandemic (online shopping refers to food that requires secondary processing, food delivery refers to food that can be eaten immediately by keeping warm)

1. Objects of online shopping during the COVID-19 pandemic (multiple choice)

- A. Fruits B. Vegetables C. Meat D. Seafood E. Snacks F. Beverages  
G. Instant food (instant noodles, etc.) H. Unable to purchase online I. Other
2. The main online shopping platform during the COVID-19 pandemic (multiple choice)  
A. Taobao B. Tmall C. JD.com D. Meituan and ELEME Takeout E. Micro-business  
F. Local WeChat mutual aid groups G. Place orders with local food merchants via WeChat  
H. Community distribution I. No online shopping or food delivery
3. The main takeaway platforms during the epidemic (multiple choice)  
A. Taobao B. Tmall C. Jingdong D. Meituan and hungry E. Micro-business  
F. Local WeChat mutual aid groups G. Place orders with local food merchants via WeChat  
H. Community distribution I. No online shopping or food delivery
4. Frequency of online shopping during the COVID-19 pandemic  
A. 1–4 times a month B. 1–3 times a week C. 4–6 times a week D. 1 time a day  
E. 2 times a day or more F. 0 times a day
5. Frequency of food delivery during the COVID-19 pandemic  
A. 1–4 times a month B. 1–3 times a week C. 4–6 times a week D. 1 time a day  
E. 2 times a day or more F. 0 times a day
6. Time spent on picking up food purchased online during the COVID-19 pandemic  
A. Within 5 minutes (home delivery) B. 6–10 minutes (pick up at the entrance of *XIAOQU*)  
C. 11–20 minutes (need to queue) D. 21–30 minutes (need to queue long time)  
E. More than 30 minutes F. No online shopping or unable to online shopping
7. The time spent on food pickup for take-out during the COVID-19 pandemic  
A. Within 5 minutes (home delivery) B. 6–10 minutes (pick up at the entrance of *XIAOQU*)  
C. 11–20 minutes (need to queue) D. 21–30 minutes (need to queue long time)  
E. More than 30 minutes
8. During the COVID-19 pandemic, did you order food delivery?  
A. Yes B. No

#### IV. Impact of the COVID-19 pandemic on life

1. During the COVID-19 pandemic, the places where you can purchase food nearby had shortened business hours, including  
A. Supermarkets B. Farmers' markets C. Convenience stores  
D. Specialized stores such as fruit supermarkets or meat stores E. Restaurants  
F. Takeaway stores or platforms

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2. During the COVID-19 pandemic, the nearby places to buy food have been closed for business, including
- A. Supermarkets B. Farmers' markets C. Convenience stores
  - D. Specialized stores such as fruit supermarkets or meat stores E. Restaurants
  - F. Takeaway stores or platforms
3. The feeling of food sufficiency in the market during the COVID-19 pandemic
- A. Very short B. There was a shortage C. Generally D. Relatively adequate
  - E. Very adequate and no difference before the epidemic
4. Whether there was a rush to buy food locally, please select the food that had been snapped up (multiple choice)
- A. Rice and noodles and other easy to store food
  - B. Instant noodles and ham sausages and other fast food
  - C. Oil, salt, soy sauce and vinegar and other condiments
  - D. Meat, eggs and milk E. Fruits and vegetables F. Mineral water
  - G. There has never been a rush H. Other
5. Have you ever snapped up food (if "yes", please answer Question 6; if "no", please answer Question 7)
- A. Yes B. No
6. Reasons for snapping up food (multiple choice)
- A. Panic caused by the shortage of food in the market B. Suggestions from friends and relatives
  - C. Influence of network news D. Single large purchase to reduce the number of times to go out
  - E. Just in time for the New Year, there are many people in the family F. Other
7. Whether friends and relatives have snapped up food
- A. Yes B. No
8. Did the concern for food safety change during the COVID-19 pandemic (multiple choice)
- A. More concerned about food safety B. More concerned about shelf life
  - C. More concerned about the origin and producer of food D. More concerned about food packaging
  - E. No difference from before the epidemic
9. What is the impact of the COVID-19 pandemic on your food purchase? (not required question)
- 
10. Are there any confirmed or suspected cases in your neighborhood?
- A. Yes B. No

Thank you very much for your reply, and I wish you and your family a safe and healthy life!