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Non-Parametric Analysis of COVID-19-Driven Online Shopping Behavior in Malaysia

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ABSTRACT

The COVID-19 pandemic has resulted in a surge in online shopping in Malaysia, which has highlighted the significance of delving into the factors that affect consumers' behavior when making purchases online. A cross-sectional survey was conducted in Malaysia between 3rd December and 27th December 2021. The study aimed to examine the differences in online shopping behavior among Malaysian consumers and used the Mann-Whitney Test and Kruskal Wallis Test for comparison when the normality assumption of the response is not normally distributed. The result demonstrates that there was a significant difference in online shopping behavior between marital status (U=5992.50, p=0.006), gender (U=5992.50, p=0.006), and different age groups (K=21.857, p=<0.001). In conclusion, the study contributes to the understanding of the characteristics of online shopping in Malaysia, including the factors that motivate consumers to shop online and the challenges they face.

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1. Introduction

E-commerce has become a popular platform to purchase their needs in this modern age as everything is at our fingertips which can be done from anywhere and anytime with just a single click [1]–[3]. The popularity of e-commerce is growing due to the convenient, affordable, and accessible shopping experience. Consumers today are too busy to visit physical stores, and online shopping allows them to shop from the comfort of their own homes [4]–[6]. Additionally, online shopping often provides lower prices compared to traditional brick-and-mortar stores, which is another factor that

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attracts consumers to online shopping [2], [4], [7], [8]. The ability to shop 24/7 and the lack of pollution associated with online shopping are other benefits that consumers appreciate [6], [9].

However, notwithstanding the popularity and advantages of online shopping, there exist certain risks that consumers should be cognizant of prior to initiating an online purchase. The risks such as non-delivery, financial risk, product risk, delivery risk, and information security have been identified as pivotal factors that significantly impact consumers' online purchasing behavior [1], [10]–[13]. Research has shown that perceived benefits and risks play a significant role in consumers' online buying behavior [6], [12]–[15]. As the store offers more benefits, it will attract more consumers and encourage them to purchase online [16]. Meanwhile, the greater the risk incurred by consumers, the lower their desire to purchase via online platforms [11], [15], [17].

Despite the importance of understanding these risks, there is limited research examining consumer behavior patterns in online buying within the context of Malaysia. The lack of information and understanding of how customers experience online shopping can lead to a lack of trust in online shopping platforms and may discourage consumers from making purchases online. The main objective of this research is to examine the differences in online shopping behavior among consumers in Malaysia. The specific research objectives are as follows:

1. To identify the factors that influence online shopping behavior among Malaysian consumers.
2. To compare the online shopping behavior of different demographic groups, such as age group, level of income, marital status, and gender.

This study contributes to the field of informatics and business by providing a deeper understanding of the factors influencing online shopping behavior in Malaysia, helping online retailers tailor their strategies to enhance the consumer experience and foster trust among Malaysian shoppers. By conducting a comprehensive analysis of online shopping behavior across various demographic groups in Malaysia, this research contributes valuable insights to the e-commerce industry, ultimately aiding in the growth and sustainability of online transactions in the Malaysian market.

2. Literature Review

Understanding consumer behavior is crucial for businesses to comprehend what consumers think, feel, and want from products or services [14], [18]. According to [19], the behavior aspect of attitude typically reflects consumers' buying intentions in terms of consumer behavior. Consumer behavior refers to the buying behavior of the ultimate consumer and involves analyzing their reactions to a firm's products or services [11], [20], [21]. Amidst exposure to a multitude of products and daily advertisements, consumers encounter the challenge of assimilating and retaining all the information and stimuli they come across. In the process of decision-making, buyers are tasked with information processing, where knowledge plays a crucial role by enhancing familiarity with the product and expertise. Meanwhile, less experienced buyers tend to rely more on price as an indicator of quality compared to those who possess product knowledge [22]. Consumers screen information that contradicts their attitudes and reshape information to align with their existing beliefs [21].

There are several factors that attract consumers to choose online shopping research have shown that factors related to perceived benefits and perceived risks significantly influence consumers' behavior in online shopping. For example, a study conducted in Pakistan found that convenience, product variety, product risk, and privacy risk were influential factors in shaping online shopping behavior, with consumer purchase intention mediating the relationship [14]. Another study examined the impact of influencer marketing on the buying behavior of young consumers and found that influencer characteristics, such as social and physical attractiveness, can affect the formation of consumer behavior [23]. Additionally, research has highlighted the importance of perceived risk as a factor in online shopping behavior, with psychological risks leading to difficulties, loss of trust, and negative psychological effects on consumers [24]. In the context of Malaysia, a study found that consumers' perceived risks of online shopping directly influence their attitude towards online shopping behavior [6], [11], [25], [26].

In general, one of the crucial antecedents of purchasing behavior is the information of consumers [26]. Different types of customers characterized by unique traits, are anticipated to adhere to distinct sets of behavioral norms and preferences. Meanwhile, customer classification is considered as a crucial aspect in the examination of online consumer behavior. A review of the literature on online shopping has found that demographic variables such as age, gender, education,

household income, marital status, and occupation have an impact on the online shopping behavior of consumers [26], [27]. Thus, it is important to determine the customers' demographics such as age, gender, and education level in the process of identifying online shoppers (or non-shoppers) and understanding their motivations for exploring online retail platforms. According to [28], consumers' decisions to make online purchase is dependent on their income, education, generational age, and consumption-related values pertinent to the products they intend to buy. However, it is still a question of how demographic variables such as age, gender, and level of income also influence consumer behavior that drives them towards online shopping, especially in Malaysia. Therefore, the role of demographics toward online shopping behavior needs to be further explored.

3. Methodology

This study sought to explore how demographic variables influence online shopping behavior within the Malaysian context. Consequently, the following hypotheses have been proposed and Figure 1 presents the conceptual model.

H1: There is a significant difference in online shopping behavior among different age groups.
H2: There is a significant difference in online shopping behavior between male and female Malaysian consumers.
H3: There is a significant difference in online shopping behavior between single and marital status among Malaysian consumers.
H4: There is a significant difference in online shopping behavior among different levels of income groups.

Based on the literature review, the research framework has been constructed as depicted in Figure 1.

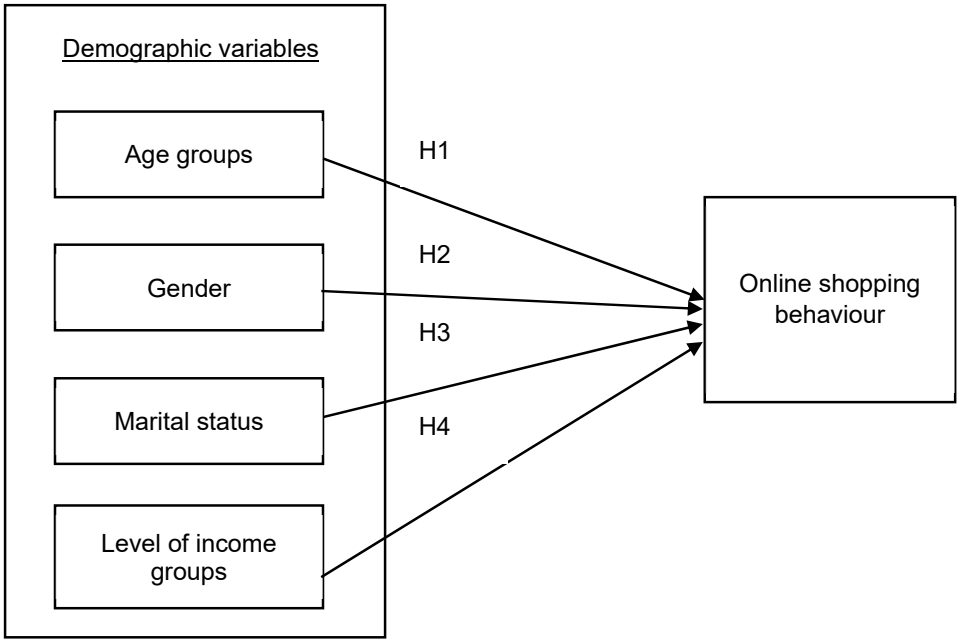

Figure 1. Conceptual model

3.1 Study Design and Sampling

A cross-sectional survey was conducted in Malaysia between the 3rd and 27th of December 2021 to examine the differences in online shopping behavior among Malaysian consumers. The survey focused on individuals aged 20 and above, currently residing within Malaysia. The survey employed a non-random convenience sampling method. A total of 251 participants completed the survey.

3.2 Research Instrument

In this research, primary data was gathered using an online survey to gather information that facilitates the measurement of respondents' perceived benefits and needs, as well as the risks that influence their online shopping behavior. Two primary channels utilized for distributing this survey were social media, particularly Facebook, and WhatsApp, as they are among the most widely used communication and social platforms in Malaysia. Before providing the link, a standardized general description of the survey was given in the WhatsApp message or social media postings. The survey instrument utilized in this study was modified and employed by multiple authors [29] – [32]. The survey consists of seven main themes: socio-demographics (9 items), convenience (4 items), product risk (5 items), privacy risk (6 items), product variety (3 items), financial risk (5 items), and online shopping behavior (4 items). In this study, a 5-point Likert scale was employed to assess respondents' levels of agreement, ranging from "strongly disagree" to "strongly agree".

3.3 Comparison using Non-Parametric Test

Non-parametric tests such as the Mann-Whitney U test and the Kruskal-Wallis test can be used as alternatives to parametric tests when comparing means in situations where the data is not normally distributed [33]. These tests do not rely on the assumption of normality and are suitable for comparing means when the data does not follow a normal distribution.

3.4 Mann-Whitney U Test

The Mann-Whitney U test is a non-parametric alternative to the independent-samples t-test and is employed when the assumptions of the t-test are not satisfied. The test involves assigning ranks to the data and calculating the U statistic, which is used to assess the difference between the groups. It is a generalization of the Mann-Whitney U test and is based on ranks.

$$U = \min(U_1, U_2) \tag{1}$$

where,

$$U_1 = n_1 n_2 + \frac{n_1(n_1+1)}{2} - R_1 \tag{2}$$

$$U_2 = n_1 n_2 + \frac{n_1(n_1+1)}{2} - R_2 \tag{3}$$

n_1 is sample size for group 1
n_2 is sample size for group 2
R_1 is sum of ranks for group 1
R_2 is sum of ranks for group 2

3.5 Kruskal-Wallis Test

The Kruskal-Wallis test, alternatively referred to as one-way ANOVA on ranks, is a non-parametric test utilized to assess whether there exist statistically significant distinctions among two or more independent groups. This is a rank-based test that does not make any assumptions about the specific distribution of the data and is employed when the data does not follow a normal distribution. The test statistic, H, is computed using the data's ranks and follows a chi-square distribution.

$$H = \left(\frac{12}{N(N+1)} \sum_{j=1}^{K} \frac{R_j^2}{n_j}\right) - 3(N+1) \tag{4}$$

where,

K is number of groups
N is total sample size

N_j is the sample size in the j^{th} group
R_j is the sum of the ranks in the j^{th} group

4. Results and Discussion

4.1 The Mean Score Analysis

Table 1 below illustrates descriptive statistics of each construct in this study which are convenience, product risk, privacy risk, product variety, financial risk, purchase intention, and online shopping behavior. Out of 5, the mean values of items under convenience ranged from 3.21 to 4.27. Thus, in general, the respondents rated 3 to 4 for the items under the convenience construct. Among the convenience attributes, respondents assigned the highest average ranking to "It is easy to find the right product online." The mean scores for product risk items ranged from 3.28 to 4.25, with the item "When buying clothes online, size may be a problem" achieving the highest mean score (4.25) in comparison to the other four items. The construct for privacy risk has an average of 3 for all items which indicates the respondents felt neutral with the items. Out of six privacy risk items, “This shopping application/website does not ask for irrelevant personal information” has the topmost mean score.

Table 1. Mean, Standards Deviation, and Variance

Construct	Item	Mean	Standard Deviation
Convenience	It is easy to find the right product online.	4.27	0.818
3.6723 ± 0.7579	It is easy to cancel orders when shopping online.	3.86	1.023
	I can examine the product when I shop online.	3.21	1.233
	I will not have problems returning products bought online.	3.35	1.129
Product Risk	I might not get what I ordered through online shopping.	3.28	1.225
3.8392 ± 0.8090	I might receive a malfunctioning product.	3.55	1.170
	It is hard to judge the quality of the product over the Internet.	4.06	1.002
	When buying clothes online, size may be a problem.	4.25	0.966
	It is difficult for me to compare the quality of similar products.	4.05	0.972
Privacy Risk 3.6401 ± 0.6891	I feel online retailers may not disclose my personal information (e.g., email, mailing address) to other companies.	3.56	0.980
	I feel online retailers may not track my shopping habits and history of purchases.	3.20	1.129
	I may not be contacted by online retailers (e.g., via email, phone call, or letter) without providing consent after the completion of the transaction.	3.55	1.107
	This shopping application/website does not ask for irrelevant personal information.	3.97	0.954
	I feel safe while doing transactions on the shopping application/website.	3.78	0.847
	I feel the monetary information that I provide on this website is well protected.	3.79	0.920
Product Variety	I can easily find the products I need in online shops.	4.30	0.750
4.4011 ± 0.6357	I have many choices of products in online shops.	4.43	0.703
	I am able to compare prices of the same product from various shops.	4.47	0.694
Financial Risk	I am concerned that I may not receive the refund.	3.67	1.120
3.2884 ± 0.9376	I might get overcharged if I shop online as the retailer has my credit card info.	3.02	1.195

	I feel that my personal information given for the transaction to the retailer may be compromised by the 3rd party.	3.28	1.089
	I feel that my credit card details may be compromised and misused if I shop online.	3.18	1.121
	I feel that my credit card number may not be secure	3.30	1.132
Online Shopping	I shop online as I can shop in the privacy of my home.	4.26	0.792
Behavior 4.2470 ± 0.6405	I shop online as I can take as much time as I want to decide and whatever I want.	4.45	0.721
	I shop online to reward myself.	4.29	0.839
	I will encourage others to shop online.	3.98	0.944

Additionally, product variety has an average of 4 on the 5-point Likert scale for all items remarks the respondents agreed with the items and "I am able to compare prices of the same product from various shops" has the highest mean score (4.47). The mean values of all five items under the financial risk construct also have an average of 3, which ranged from 3.02 to 3.67. Item "I am concerned that I may not receive the refund" is superior to the others with a 3.67 mean score. Next, respondents showed a neutral to agree feeling of purchase intention, ranging from 3 to 4, and proved the highest value of mean (4.23) for the attribute "The reviews influence my intention to purchase online". The mean score for online shopping behavior is from 3.98 to 4.45 and respondents agreed to "I shop online as I can take as much time as I want to decide and whatever I want" item the most.

4.2 Normality Test

Prior to conducting comparative differences analysis, the normality assessment using the Shapiro-Wilk test was designed to evaluate normality, as indicated in Table 2. This statistical evaluation was essential to ensure the appropriateness of the subsequent comparative analysis, providing a vigorous foundation for the research findings.

Table 2. Test of Normality (Shapiro Wilk)

Construct	**Statistics**	**Sig.**	**Interpretation**
Online Shopping Behavior	0.914	0.000**	Not normally distributed

*** Correlation is significant at the 0.01 level (2-tailed).*

The outcomes of the normality tests presented in Table 2 clearly indicate that the distribution of online shopping behavior data was found to significantly deviate from a normal distribution (p-value=0.000). Consequently, to ascertain significant differences in online shopping behavior across various demographic profiles of consumers, non-parametric statistical methods have been employed, specifically the Mann-Whitney U and Kruskal-Wallis tests. These robust non-parametric tests are well-suited for the dataset and will provide reliable insights into the relationships between demographic factors and online shopping behavior, ensuring the accuracy and validity of our research findings.

4.3 Mann-Whitney and Kruskal-Wallis Test

Table 3 presents the examination of online shopping behavior in relation to socio-demographic characteristics, even in cases where the data deviate from normal distribution. This robust analysis enables us to uncover significant insights into how various socio-demographic factors influence online shopping behavior, contributing to a comprehensive understanding of consumer preferences in the digital marketplace.

Table 3. Comparison of Online Purchase Intention with Socio-Demographic Characteristics

Variables	Mean rank score	Sig.
Age Groups	21.857[K]	<0.001**
20 – 29	140.61	
30 – 39	130.19	
40 – 49	87.740	
50 and above	101.12	
Gender	5307.00[U]	0.006**
Male	107.54	
Female	134.32	
Marital Status	5992.50[U]	0.006**
Single	136.08	
Married	110.53	
Income Groups	6.482[K]	0.090
< RM 2000	133.52	
RM 2000 – RM 3000	108.86	
RM 3000 – RM 4000	110.08	
> RM 4000	118.00	

[K] is Kruskal Wallis Test, [U] is Mann-Whitney U Test,
*** Correlation is significant at the 0.01 level (2-tailed).*

A Mann-Whitney U test was conducted to compare the online shopping behavior of single and married consumers. The test showed that there was a significant difference (U=5992.50, p=0.006) between single and married consumers. The mean rank of online shopping behavior score for those who are still single (136.08) is slightly higher than those married (110.53). Conversely, when applying the Mann-Whitney U test to examine gender differences, a significant distinction emerged (U=5992.50, p=0.006) between female and male consumers. The mean rank for females (134.32) indicated a slightly higher online shopping behavior rank compared to males (107.54). A Kruskal-Wallis Test showed that online shopping behavior significantly affect by different age groups (K=21.857, p=<0.001) where the mean rank of age categories of 20-29 years was the highest (140.61) online shopping behavior, followed by 30-49 years (130.19), 50 and above groups (101.12), and 40-49 years (87.740) age groups respectively. The result of the Kruskal Wallis Test revealed insignificant differences in online shopping behavior among income groups (K=6.482, p=0.090).

5. Conclusion

In summary, Malaysian consumers demonstrate favorable online shopping tendencies, with product variety emerging as the primary factor that attracts them to engage in online purchases. Remarkably, Malaysian consumers tend to rate privacy risk and financial risk neutrally or express uncertainty when engaging in online transactions. The study also found that there were significant differences in online shopping behavior between different demographic groups, including marital status, gender, and age groups, but no differences were observed in different income groups.

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Conflict of Interest

The authors declare no conflict of interest in the subject matter or materials discussed in this manuscript. Additionally, the authors declare no conflict of interest related to authorship or editorial responsibility for this manuscript.

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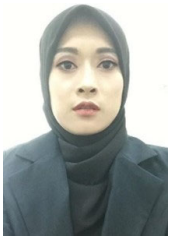
Biography of all authors

Picture	Biography	Authorship contribution
	Dr. Nurhasniza Idham Abu Hasan obtained her first degree in Bachelor of Science (Hons.) (Statistics) from the Universiti Teknologi MARA, Malaysia in 2008. She received a master's and PhD degree in Statistics from the same university in 2011 and 2018 respectively. Currently, she is a senior lecturer at the Universiti Teknologi MARA, Malaysia. Her research interests include regression and predictive model, epidemiology, survival analysis, mixture cure model, and public health.	Design the research work, data analysis and drafting article.
	Dr. Mogana Darshini Ganggayah is a lecturer at the Department of Econometrics and Business Statistics, School of Business, Monash University Malaysia. Her academic journey commenced with a Bachelor of Science in Bioinformatics with Distinction from Universiti Malaya, Kuala Lumpur, Malaysia in 2018. Driven by her passion for data science, she embarked on a fast-track PhD program in Data Science, successfully completing her candidature in February 2021.	Data analysis and interpretation.
	Siti Hasma Hajar binti Mat Zin is a lecturer at the Mathematical Sciences Studies, College of Computing, Informatics and Media, Universiti Teknologi MARA (UiTM), Johor Branch, Segamat Campus. She obtained her Master's Degree (Science) in Applied Statistics. Her research interests include Applied Statistics, Statistical Modelling And Statistical Education.	Literature review.
	Nur Ain Izzati Binti Abdul Razak is a final year student in Bachelor of Computer Sciences at the College of Computing, Informatics and Media, Universiti Perak Branch, Tapah Campus, Perak, Malaysia. Currently, she is undergoing Master in Statistics at Universiti Teknologi MARA Shah Alam.	Data collection, Data analysis and interpretation.
	Nur Faezah Jamal is a Senior lecturer at Mathematical Sciences Studies, College of Computing, Informatics and Media, Universiti Teknologi MARA (UiTM), Perak Branch, Tapah Campus. She also graduated from University Technology MARA, Malaysia and received Master's in Applied Statistics in 2011. Her research area is related to Applied Statistics.	Camera ready.