RESEARCH ARTICLE

A Multi-group Analysis of Gender Difference in Consumer Buying Intention of Agricultural Products via Live Streaming

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Abstract: This study tries to understand the determinants of Chinese consumers' purchase behavior and reveal the role of gender in shaping consumers' buying decisions for agricultural products from live-streaming platforms. For this purpose, an online survey was carried out to collect data in Southern China. Partial least squares structural equation modeling (PLS-SEM) was employed for path analysis and multi-group analysis. The results confirm the substantial influences of consumer attitude, subjective norms and perceived behavioral control on consumer buying intention. Next, gender difference only exists concerning the effect of perceived behavioral control on consumer intention. However, the gap between male and female consumers on this point is small. Furthermore, as each factor affects consumers' purchase intention differently, corresponding implications are provided.

Keywords: PLS-SEM; Permutation test; Live-streaming commerce; Gender differences; Agriculture marketing

1. Introduction

Agricultural products refer to "any agricultural commodity or product, whether raw or processed, including any commodity or product derived from livestock for human or livestock consumption" [1]. Generally, fresh products like vegetables and fruits are easily perishable [2]. In this case, an effective agricultural product supply chain is critical. For example, if perishable products can be sold and quickly delivered to consumers in the shortest possible time, the losses of farmers can be significantly reduced [2]. Hence, live-streaming commerce plays a crucial role. Yu and Zheng (2022) [2] defined live streaming as "an emerging online social and commerce tool", and live streaming commerce emerged when many anchors used live streaming as a means of real-time interaction with customers to sell products [3]. Therefore, live-streaming commerce is deemed the latest trend in e-commerce [4,5].

The emergence of COVID-19 has given birth to new

business models and formats, such as "live streaming of agricultural products" [6], which stands out among many agricultural product online marketing models with its unique advantages, showing huge development potential [7]. Live-streaming commerce has effectively activated the stalemate in the sales of agricultural products in the region and has been widely practiced by farmers and concerned by society in China. The sales of agricultural products on the live broadcast e-commerce platform have skyrocketed, which not only lifted many farmers out of poverty and promoted the development of the local economy but also popularized knowledge about agriculture and agricultural products to the public [8]. For instance, the sales of agricultural products achieved 6 billion yuan, and over 500 county magistrates became live-streaming anchors, assisting farmers in increasing their income [6,9]. More interestingly, as revealed by the "2022 China Agricultural Products E-commerce Development Report", digital transformation and innovation become the new hot spots for the expansion of agricultural products in 2021, which has triggered different ways to promote agricultural products in online settings [10]. In this context, the prevalent live streaming of agricultural products will likely shorten the distance between farmers and the market and allow the unique agricultural products in rural areas to be sold farther and better. In addition, the promotion cost of live streaming is relatively low. Due to market supply and demand information asymmetry, many unique agricultural products often need to be discovered. Compared with advertising, live streaming has lower operating costs and broader coverage and is not limited by the market, time, and space. Therefore, live streaming has gradually become an essential means of agricultural product sales [11].

As an emerging trend of marketing, live streaming commerce is still in its' infant stage [12], which consequently has attracted attention from mainstream scholars who have emphasized consumer behavior in a general context, including Sun et al. (2019) [13], Sohn and Kim (2020) [14], Wongkitrungrueng and Assarut (2020) [15], and Molinillo et al. (2020) [16], etc. However, two research gaps require more attention. First, there still needs to be more evidence to reveal how consumers respond to live streaming in the context of agri-food marketing [17]. The use of live-streaming for agricultural product marketing is a relatively new form to promote agriculture in the digital age, and research on how consumers respond to this type of agricultural product marketing is still limited. Further research is needed to understand the effectiveness of live streaming as a marketing tool for agricultural products and to identify the most effective strategies for reaching consumers through live streaming. Second, it is meaningful to

discover the role of gender in the live-streaming setting. Gender is a universal characteristic independent of culture and time period [18]. Generally, male and female consumers have different motivations, views, reasons, and concerns about shopping [19]. Various studies [20-22] have revealed the effect of gender in e-commerce; still, similar studies are limited to live-streaming commerce [23]. Thus, further research is needed to understand the impact of gender on consumer behavior and purchase decisions in the context of live commerce. This information may be useful to marketers and businesses looking to effectively target and engage audiences through live streaming. For this reason, we intend to apply the theory of planned behavior (TPB) to reveal how consumers' attitudes, subjective norms, and perceived behavior control influence consumers' buying intention for agricultural products in live streaming. Further, we attempt to understand how male and female consumers react to buying agricultural products through live-streaming platforms.

This study is structured as follows. The literature review will be discussed in the second section followed by the research method in the third section and the findings in the fourth section. Discussion and conclusion are provided in the fifth section, and the managerial implication is discussed in the sixth section.

2. Literature Review

2.1 Theory of Planned Behavior (TPB)

The theory of planned behavior developed by Ajzen (1991) [24] is an essential social psychological model that aims to illuminate differences in the voluntary behavior of consumers [25]. TPB model has been widely acknowledged and applied because of "its strong predictive power and high validity" [26].

In the TPB model, individual behavioral intention is directly affected by individual attitude, subjective norm (SN), and perceived behavioral control (PBC) [24,27]. As an endogenous variable, intention implies an individual consumer's readiness to engage in a specific behavior, such as purchasing [28,29]. According to Roseira's study [30], the higher level of purchase intention that consumers generate, the more possibility that consumers will make an actual purchase. Thus, purchase intention is deemed the most critical step for the food industry [2]. The first antecedent is the personal attitude, a willingness generated from past experience that influences a person's response to a particular object or situation [27,31]. Regarding attitude toward a particular behavior, it is about a person's assessment of performing a particular behavior [26]. If an individual possesses a positive attitude towards a behavior, his

or her intention to engage in a particular action tends to be more robust [24,32]. Previous studies, including Gidaković et al. (2022) [33], Shihab and Putri (2018) [34], and Singh & Banerjee (2018) [35] have also proved the significant role of attitude in influencing consumer purchase intention. The second antecedent is perceived behavioral control, which relates to "personal control over the internal resource, such as confidence, skills or ability" [36]. Perceived behavioral control manifests how difficult or easy it is to perform a behavior [24,37]. Various studies have confirmed perceived behavioral control's significant role in predicting an individual's behavioral intention [37-39]. For the third antecedent, the subjective norm is described as the perception of general social pressure [36] regarding how behavior is viewed by references such as friends, parents, relatives, and colleagues [26,27]. Prior studies have shown the substantial effect of subjective norms on behavioral intention [37,40,41]. Accordingly, the following hypotheses are developed:

H1: Attitude towards buying agricultural products significantly affects purchase intention.

H2: Perceived behavioral control significantly affects purchase intention.

H3: Subjective norm significantly affects purchase intention.

2.2 Gender

Gender strongly influences consumers' cognitive thinking, emotional feelings, and purchasing behavior [42-44]. Gender differences are assessed based on a constellation of factors that crucially affect consumer behavior, including "perception, attitude, motivation, preferences, perceived risk and satisfaction" [45]. More importantly, gender is associated with psychological and sociocultural behavioral traits in men and women [46,47] who present different states when processing information and making decisions [48]. For instance, women tend to be influenced by the surrounding environment [49]. Women spend more time shopping and evaluating relevant product information [50,51] than men, who perceive shopping as a mission and pay attention to the items they need [52]. Thus, to develop more accurate strategies and campaigns to effectively and efficiently reveal the preferences of male and female consumer groups, an exploration of the similarities or differences between the two consumer groups becomes desirable [46].

In recent years, gender differences have prevailed in understanding consumer behavior and attitude in the e-commerce milieu. There are significant gender differences in cognitive, affective, and behavioral attitudes toward online shopping [19], online purchase intention [53], and loyalty intention [54], etc. Notably, gender serves as a moderator in various previous studies. For example, gender is treated as a moderator when applying UTAUT and UTAUT2 [21,55]. Gender moderates the association between consumers' online shopping motivations and their shopping intentions [56], between consumers' perceptions and trusts to trigger users' intention to use electronic payment [57], and between consumers' perceived benefits and online repurchase intention [58]. However, the impact of gender on live e-commerce remains to be explored. For this reason, this study focuses on gender differences in consumers' buying intention of agricultural products in live streaming. Consequently, the following hypotheses are developed:

H4: The strengthening of the relationship between attitude towards buying agricultural products and purchase intention will differ between male and female consumers.

H5: The strengthening of the relationship between perceived behavioral control and purchase intention will be different between male and female consumers.

H6: The strength of the relationship between subjective norm and purchase intention will vary between male and female consumers.

3. Research Design

The data collection was conducted online in Southern China from January to April 2020. G*Power was applied to verify the least possible sample size for the study. The results showed that at least 77 respondents should be recruited to ensure the study had a power level of 80% with a small effect size of 0.15 at a significant level of 5%. Eventually, 400 sample sizes were obtained with valid information; thus, the sample size of this study was considered sufficient for further data analysis.

Regarding questionnaire design, there are four items measuring attitude towards buying agricultural products, four assessing subjective norm, three measuring perceived behavior control, and three evaluating purchase intention. A 5-point Likert scale developed by Rensis Likert [59] was applied to evaluate to what extent respondents agree or disagree with a given statement [60]. The items were derived from the manual "Constructing a Theory of Theory of Planned Behavior Questionnaire" developed by Ajzen (https://people.umass.edu/aizen/tpb.html) (see also Xu et al., 2022) [28].

More importantly, partial least squares structural equation modelling (PLS-SEM) was utilized in this study. In the study of Xu et al. [28], the impacts of consumer attitudes, subjective norms, and perceived behavioural control on consumers buying intention were tested by structural equation modelling to provide a general scenario of consumers' responses to live shopping. In this study, based on existing findings, we not only further examined

the structural relationship between the proposed structures via PLS-SEM, but also specifically examined multigroup analysis based on permutation tests [61]. Consquently, more accurate and up-to-date consumer information will be obtained, such as how are male and female consumers similar or different in live shopping, particularly for agricultural products. Firms and scholars can develop more precise market strategies for different customer groups in more detail. For this purpose, Partial Least Squares Multigroup Analysis (PLS-MGA) was conducted.

4. Results

4.1 Evaluation of Measurement Model

Construct reliability and validity

Table 1 shows this study's construct reliability and validity, consisting of the factor loading, Cronbach's alpha, Dijkstra–Henseler's rho_A, Composite Reliability, and Average Variance Extracted (AVE).

Regarding factor loadings, all loading values are more significant than 0.7. Also, the AVE values of all constructs are more than the cutting-off point of 0.5 suggested by Hair et al. (2017) [62]. Therefore, the convergent validity is confirmed. Next, Cronbach's alpha values varied from 0.827 to 0.861, over 0.7 advised by Nunnally and Bernstein (1994) [63]. As for composite reliability (C.R), all values

are more significant than a recommended value of 0.7 [64]. Besides, Dijkstra–Henseler's rho_A [65] is a vital measure of internal consistency reliability for PLS-SEM, and all values should be greater than 0.7 [66,67]. Hence, since all values fulfil the criteria, internal consistency is confirmed.

Discriminant validity

Heterotrait-Monotrait (HTMT) ratio of correlation is applied to evaluate discriminant validity [66]. HTMT is "the ratio of the between-trait correlations to the within-trait correlations" [62]. The thumb of rule is that if the value of HTMT is above 0.9, we failed to verify the existence of discriminant validity [62,64,67]. Table 2 reveals that all values of HTMT are smaller than 0.9; consequently, discriminant validity is proved.

4.2 Evaluation of Structural Model

Table 3 shows the outcomes of hypothesis testing in which all the hypotheses are supported. Subjective norm ($\beta = 0.400$, $t = 7.398$) affects consumers' purchase intention most followed by attitude towards buying agricultural products ($\beta = 0.283$, $t = 4.810$) and perceived behavior control ($\beta = 0.126$, $t = 3.166$). In addition, the multicollinearity issue is not detected as all values of VIF are less than 3 [62,64]. Figure 1 visualizes the path analysis by presenting both path coefficient and t values.

Table 1. Construct reliability and validity.

	Factor loading	Cronbach's Alpha	rho_A	Composite Reliability	AVE
Attitude toward buying agricultural food (ATT)		0.827	0.828	0.885	0.658
ATT1	0.790				
ATT2	0.819				
ATT3	0.829				
ATT4	0.807				
Perceived behavioral Control (PBC)		0.838	0.850	0.902	0.754
PBC1	0.895				
PBC2	0.847				
PBC3	0.863				
Subjective Norm (SUB_N)		0.843	0.844	0.895	0.680
SN1	0.825				
SN2	0.826				
SN3	0.824				
SN4	0.823				
Purchase Intention (INT)		0.861	0.863	0.915	0.782
INT1	0.883				
INT2	0.875				
INT3	0.895				

Table 2. Heterotrait-Monotrait ratio (HTMT).

	ATT	INT	PBC	SUB_N
ATT				
INT	0.626			
PBC	0.128	0.212		
SUB_N	0.701	0.671	0.071	

Table 3. Hypothesis testing.

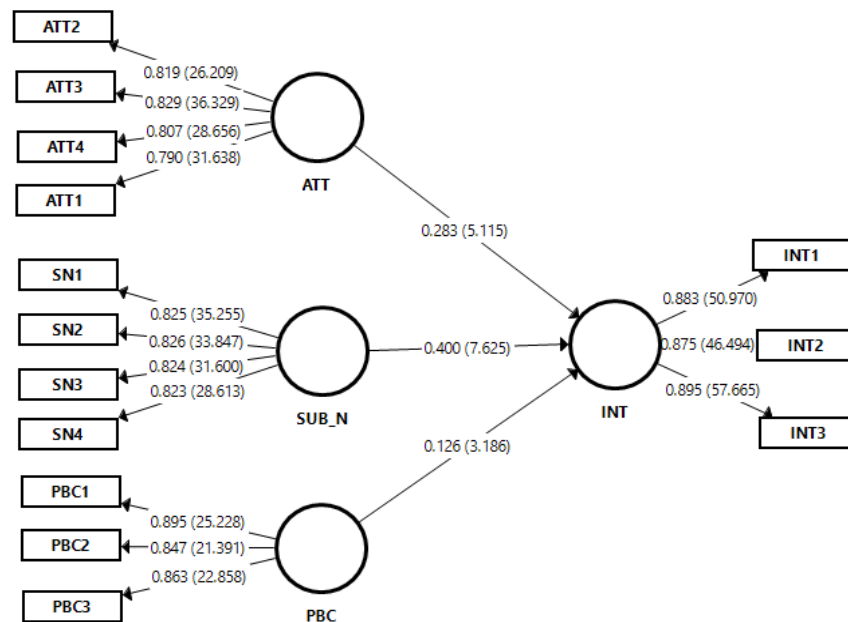|	Path	VIF	Path Coefficient	T Values	95% Confidence Intervals	P Values	Decision
H1	ATT -> INT	1.534	0.283	4.810	[0.172, 0.297]	***	Support
H2	PBC -> INT	1.011	0.126	3.166	[0.047, 0.204]	**	Support
H3	SUB_N -> INT	1.523	0.400	7.398	[0.290, 0.494]	***	Support

*** p<0.001 ** p< 0.01

Figure 1. Path coefficient.

4.3 Multi-group Analysis

Before proceeding to multi-group analysis, model fit was proved including Standardized Root Mean Square Residual (SRMR) = 0.054, Normed Fit Index (NFI) = 0.962, Exact fit criteria d_ULS = 0.310 and d_G = 0.152. Then, a power analysis was conducted to ensure that the number of observations in each group would meet the minimum sample size [68]. The results derived from G*Power showed that 64 observations in each group were required to reach a power level of 80% at a significant level of 5%. Thus, the group-specific sample size for both males ($N = 155$) and females ($N = 245$) was regarded as sufficient.

Next, measurement invariance was evaluated, which was a vital step before the multigroup analysis [68]. If invariance cannot be proved, it will result in the "low power of a statistical test, the poor precision of estimators, and misleading results" [68,69]. In this context, the measurement invariance of composite models (MICOM) procedure developed by Henseler et al. (2016) [66] was introduced, which consists of three steps: 1) Evaluating configural invariance, 2) establishing compositional invariance, and 3) assessing equality of a composite's mean value and variance across groups [68-70]. Accordingly, the permutation test was applied [61].

Table 4 presents the results of MICOM using the permutation test. Firstly, in general, configural invariance is automatically established at step 1. Next, in step 2 correlations between the composite scores are compared with a 5% quantile for all variables (ATT, INT, PBC and SUB_N). The results show that only the quantile of PBC was

smaller than its correlation, indicating that compositional invariance was only established for the construct of PBC. Consequently, partial measurement invariance of PBC was confirmed. In step 3, the equality of mean (3a) and variance (3b) were tested. The original difference between male and female groups is compared with 95% confidence intervals. At step 3a, the mean of ATT and PBC fell "within the 95% confidence interval of the lower (2.5%) and upper (97.5%) boundaries" [70] At the same time, INT and SUB_N did not, meaning that there were no significant differences between mean values of two groups (male Vs. female) for ATT and PBC constructs. At step 3b, only the variance of PBC fell within the 95% confidence interval, concluding that full measurement invariance was established only for PBC construction.

Further, Henseler's MGA (PLS-MGA) [66] was applied to analyze group-specific differences [68,71]. Henseler's MGA is a nonparametric test that generates boostrapping results for each group [66,68,69]. By using PLS-MGA, "a p-value of differences between path coefficients lower than 0.05 or higher than 0.95 indicates a 5% level of significant difference between specific path coefficients across two groups" [70,72]. Table 5 reveals that gender difference exists regarding the effect of PBC on INT while no differences are found in the paths from ATT and SUB to INT. However, male and female have little difference in the impact of PBC on INT as the path coefficient difference is 0.002.

5. Discussion and Conclusions

The hypothesis testing results confirm the significant influences of attitude towards buying agricultural products (H1), perceived behavior control (H2), and subjective norm (H3) on consumers' intention to buy agricultural products. Interestingly, the subjective norm is the most influential factor, which shows the importance of group influence in Chinese society. Under the influence of group consciousness and norms, social groups can produce common and consistent behaviors at any time. In this paper, consumers' purchase intention is influenced by the group they belong to and the people around them, that is, the preference of the people around them (family members, relatives, friends, or colleagues, etc.) for a particular product or a brand will influence their purchasing decision.

Next, in terms of multi-group analysis of gender difference, through measurement invariance of composite models (MICOM) procedure, full measurement invariance was established only for perceived behavioural control. Further, the multi-group analysis results reveal gender differences in predicting perceived behavioral control on consumer intention, indicating that the relationship between perceived behavior control and intention is slightly stronger for female consumers. It can be said that female respondents did not perceive buying agricultural products from a live-streaming commerce platform as complex.

Table 4. Results of measurement invariance assessment based on a permutation test.

	Configural invariance (step 1)	Compositional invariance (step 2)		Partial Measurement Invariance	Equal Mean (step 3a)		Equal Variance (step 3b)		Full Measurement Invariance
		Original Korrelation	5%		Original Difference	Confidence Interval	Original Difference	Confidence Interval	
ATT	Yes	0.989	0.996	No	−0.089	[−0.173, 0.183]	0.765	[−0.397, 0.450]	Yes/No
INT	Yes	0.998	0.999	No	−0.176	[−0.176, 0.163]	0.777	[−0.392, 0.407]	No/No
PBC	Yes	0.977	0.971	Yes	−0.154	[−0.168, 0.159]	0.159	[−0.166, 0.180]	Yes/Yes
SUB_N	Yes	0.990	0.996	No	−0.377	[−0.158, 0.172]	0.949	[−0.386, 0.416]	No/No

Table 5. Results of the structural equation model multi-group analysis.

	Female		Male		Path coefficient difference	Henseler's PLS-MGA
	Path Coefficient	Confidence Intervals (Bias Corrected)	Path Coefficient	Confidence Intervals (Bias Corrected)		
ATT➜INT	0.319	[0.169, 0.486]	0.159	[−0.298, 0.242]	0.160	0.064
PBC➜ INT	0.124	[0.041, 0.203]	0.122	[−0.154, 0.252]	0.002	0.971**
SUB_N➜ INT	0.409	[0.259 0.540]	0.310	[0.141, 0.503]	0.099	0.205

*** p < 0.01; ** p < 0.05

This phenomenon may be related to the increasing number of female anchors on live broadcast platforms. As pointed out by Chen (2021) [73], by 2020, female anchors in China's live-streaming commerce industry accounted for 65.3%, and among the three platforms of Taobao, Kuaishou, and Douyin, female anchors account for 71.5% in Kuaishou. 68.3% in Taobao and 57.5% in Douyin. Compared to male consumers, female anchors are more able to resonate with female consumers. In Chinese society, women usually spend more energy and time caring for their families. For example, they care about what their family eats, how to eat healthily, etc. The positioning of this traditional role also makes female consumers more willing to take the time to understand the agricultural products sold in the live broadcast room and actively interact with anchors seeking (predominantly female anchors) more relevant information. Therefore, they will feel that it is easy to buy agricultural products via live-streaming commerce platforms.

This article also has its limitations. First, limited to quantitative research, it is impossible to obtain rich descriptive data on specific phenomena of consumers' behavior in purchasing agricultural products. Therefore, future studies using mixed methods studies are encouraged. Furthermore, in addition to gender differences, intergenerational differences can also be used for future research. Generation Y and Z's consumption behaviors, characteristics, and patterns in online shopping are a good focus.

6. Implications

6.1 Theoretical Implications

This study contributes to the existing literature in several ways. First, it confirms the validity of the Theory of Planned Behavior (TPB) in the context of agricultural marketing. Second, the study reveals the importance of gender differences in promoting agricultural production in a digital setting. Therefore, this study can be used as a reference to explain the role of gender in encouraging consumers' choice of agricultural products.

6.2 Managerial Implications

At a practical level, managerial implications are provided to increase consumer intention to buy agricultural products.

As far as subjective norms and attitudes are concerned, the "Family Coupon" program can be implemented in the live-streaming room of agricultural products to provide different degrees of discount. Consumers can apply for "parent-child coupons" in the live broadcast room or platform to share with relatives and friends. With more participation of relatives and friends, consumer attitude towards buying agricultural products will be more positive. This will trigger consumers' willingness to buy agricultural products.

As far as perceived behavior control is concerned, mainly when gender difference is considered, it is suggested that the live-streaming room or commerce platform should make purchasing more convenient and more manageable. In e-commerce, male consumers are generally more intuitive than female consumers. They tend to get information directly to make better comparisons; therefore, the convenient and time-saving live-streaming shopping experience is more favored by male consumers. Consequently, if live-streaming anchors or platforms provide more detailed product information while promoting agricultural products, it will reduce ambiguity. The policy to claim for the product return, to redeem to get gifts or discounts should be clear to reduce the risk. In addition, live-streaming platforms should conduct regular reviews of agricultural products quality and production qualifications to reduce consumer concerns about such issues. These practices will benefit both female and male consumers. Live broadcast platforms and anchors should strive to provide consumers with a safe, simple, and intuitive consumption experience while promoting agricultural products to increase consumers' intention to purchase and ultimately promote actual purchase behavior.

Author Contributions

Bing Zhu: writing, methodology, data analysis and conceptualization; Ping Xu is writing, data collection, conceptualization.

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Data Availability

Raw data are from China. The questionnaire and derived data supporting the findings of this study are available from the first author, Bing Zhu, upon request.

Conflict of Interest

The authors report that there are no competing interests to declare.

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