ИССЛЕДОВАНИЕ ДИНАМИЧЕСКОЙ СВЯЗИ МЕЖДУ КОНТЕНТОМ ПРЯМОЙ ТРАНСЛЯЦИИ, ОНЛАЙН-КОММЕНТАРИЯМИ И НАМЕРЕНИЕМ ПОТРЕБИТЕЛЯ СОВЕРШИТЬ ПОКУПКУ

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Аннотация. Выявляется фактическое влияние электронной коммерции в прямом эфире на факторы, определяющие намерение потребителя совершить покупку. Даются рекомендации компаниям электронной коммерции по оптимизации контента прямых трансляций и улучшению показателей продаж. В качестве информационной базы исследования использовались данные 100 прямых трансляций. Оценивается модель множественной линейной регрессии, содержащей несколько переменных-предикторов, и анализируется, как эти переменные влияют на намерение потребителя совершить покупку. Результаты оценки модели показывают, что переменные-предикторы воздействуют на намерение потребителя совершить покупку и могут объяснить 75 % изменений продаж.

Ключевые слова: электронная коммерция в прямом эфире; качество контента; разнообразие контента; онлайн-комментарии; намерение совершить покупку.

RESEARCH ON THE DYNAMIC LINK BETWEEN LIVE BROADCAST CONTENT, ONLINE COMMENTS AND CONSUMER PURCHASE INTENTION

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Abstract. The purpose of the article is to reveal the actual effect of live broadcast e-commerce on factors affecting consumer purchase intention, and to help e-commerce companies and network anchors optimise live broadcast content and improve sales performance. The data of 100 live broadcasts was the research information base for quantitative analysis. Using these data the authors built the multiple linear regression model containing multiple predictor variables, and explore how these predictor variables affect consumer purchase intention. The results of the model estimation show that the predictor variables have a significant impact on consumer purchase intention and can explain 75 % of the change in sales.

Keywords: e-commerce live broadcast; content quality; content diversity; online comments; purchase intention.

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Introduction

In the global retail business field, e-commerce live broadcast is rapidly becoming a transformative force that cannot be ignored. Combining real-time video and e-commerce, this model gives consumers a new interactive shopping experience, while having a profound impact on corporate market strategies and global economic patterns.

E-commerce, live broadcast e-commerce and livestream shopping are all different names for this same concept. The live commerce format assumes that the presenter talks about the product, demonstrates its advantages, describes how to use it, and answers questions from the audience. Short video is a new tool, a new form of video content designed to attract the attention of subscribers in order to promote a brand and increase sales. All this, of course, is a subject to compliance with the requirements for content quality. This phenomenon is expected to continue it's spread − sales from live commerce are predicted to reach 55 bln US dollars in the US by 2026 (expert assessments by the company *Statista*).

According to data released by the Ministry of Commerce of China, the country's national online retail sales in 2022 were 13.79 trln yuan, an increase of 4 % year-on-year[1]. According to the 2022 China live broadcast e-commerce market data report[2], the scale of live broadcast e-commerce transactions in 2022 reached 3.5 trln yuan, an increase of 48.21 % year-on-year, with 473 mln users and a live broadcast e-commerce penetration rate[3] of 25.3 %. This shows the importance and potential of live broadcast e-commerce in the e-commerce market. The influence of live broadcast of e-commerce far exceeds the indicators of its market share. As an innovative business model, it is changing the operating logic of the entire retail industry. In the traditional retail model, the supply chain links are complex and the information transmission efficiency is low. The e-commerce live broadcast mode greatly optimises this process, enabling consumers to interact with businesses in real time and deepen consumer's understanding and trust in products. This highly interactive shopping experience not only improves consumer satisfaction, but also significantly improves conversion rates.

In the context of the deep integration of the Internet and e-commerce, e-commerce live broadcast, as a new type of sales model, has a unique content display and user interaction mechanism. Although the importance of e-commerce live broadcast is becoming more and more prominent, its influence mechanism on consumer buying behaviour has rarely been studied in depth. The existing research mainly focuses on the purchase decision-making model of traditional e-commerce. For the new model of e-commerce live broadcast, which integrates social, entertainment and shopping, its behavioural model still needs to be deeply explored. Especially, how live broadcast content and online comments affect consumer purchase intention, there is still a lack of systematic theoretical and empirical analysis on this issue. On this basis, two core questions are put forward: the first is how the content quality and diversity of e-commerce live broadcasts affect consumer purchase intention; the second is how online comments affect consumer purchase intention, and whether there is an interactive effect between the two.

The purpose of this research is to explore the above-mentioned issues in depth from the theoretical and empirical levels, in order to provide more rich and more accurate theoretical explanations and empirical evidence. Specifically, the theories of economics and consumer behaviour will be used to construct models and put forward hypotheses; then actual data will be used for empirical testing to verify the correctness of the hypotheses. Expected contributions are following. From a theoretical point of view, the research will enrich and deepen the theory of consumer buying behaviour, especially the theory of consumer behaviour in the new sales scenario of e-commerce live broadcast. From a practical point of view, the research will provide companies with strategic suggestions to help them to use e-commerce live broadcast and online reviews for increasing sales more effectively.

Literature review

Many scientists carried out live e-commerce right research on the impact of consumer purchase intention. Zhu Haiyan and Jiang Jiang emphasised the key roles of the entertainment, professionalism and similarity of anchors in the willingness to buy [1]. Li Siying further revealed how e-commerce live broadcast content and online reviews can enhance consumer purchase intention, and found that online reviews have an intermediary role [2]. Liu Luman explored the influence of consumer-created content and marketer-created content on purchase intent, and proposes that perceived information quality and perceived usefulness play an intermediary role in it [3]. Chen Zhangwang, He Huiling, Zhu Yindi studied the influence of e-commerce live broadcast

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[1]Online retail sales in China // The State Council of the People's Repub. of China : site. URL: http://www.gov.cn/xinwen/2023-01/31/content_5739339.htm (date of access: 25.10.2023) (in Chin.).

[2]2022 China live broadcast e-commerce market data report [Electronic resource]. URL: http://epaper.qdcaijing.com/pad/content/202303/23/content_350917.html (date of access: 25.10.2023) (in Chin.).

[3]Live streaming e-commerce penetration rate is live streaming e-commerce transaction size or online retail transaction size.

characteristics on purchasing willingness, and confirmed the intermediary effect of dual-channel psychological accounts [4]. Wang Hong, Chen Huilin, Xie Jiaqian, Wen Sili basing on the stimulus – organisation – response theoretical model, studied the influence of the language content characteristics of the anchor on consumer purchase intention, revealing the importance of consumer's perceived value [5]. From the perspective of content marketing, Zeng Lan and Qiu Huicui confirmed the positive influence of information content, entertainment content, and emotional content on consumer's willingness to buy [6].

A lot of works are devoted to the impact of online reviews on consumer purchase intentions. Guo Yongchao believed that the length, professionalism and informational nature of online instant reviews all have a positive impact on consumer purchase intention [7]. Yao Qi, Yang Lin, Hu Chao discussed the influence of composite comments on consumer's willingness to buy from the perspective of perceived comment credibility [8]. Han Yutong, Zhou Jilei, Ren Fei found that in the live broadcast e-commerce model, the information richness of real-time comments had a positive impact on commodity sales [9]. Li Youzhu, Gao Xianghui, Qiao Mengyu, He Rui studied the positive relationship between review value, consumer psychological factors, store reputation factors and consumer's willingness to buy [10], while Wu Qingyi and Huang Fei pointed out that the potency of numerical online reviews had an impact on consumer's willingness to screen products [11]. Du Huiying, Wang Xingfen, Zhuang Wenying further emphasised the main influence of online evaluation of self-factors and seller factors on consumer's shopping decisions [12]. Research by Zhu Liye, Yuan Denghua, Zhang Jingyi and another one by Du Xuemei, Ding Jingyu, Xie Zhihong, Lei Lifang pointed out that the quality of comments, the level of reviewers, the number of comments, and the potency of comments all have a positive impact on consumer purchase intention. Among them, the quality of comments has a particularly significant impact on the willingness to buy in the case of high product engagement [13–15].

Although many studies have focused on the impact of e-commerce live broadcasts and online comments on consumer's willingness to buy, there are still limitations in the current research. Most of them only focus on a single influencing factor such as anchor characteristics or online comment characteristics, and focus too much on consumer behaviour results and ignore behavioural processes, such as how consumers interpret live broadcast content and online comments, and lack of an investigation the of individual differences such as gender, age, and consumption habits impact on purchasing willingness. Therefore, the research aims to make up for these shortcomings, build a comprehensive theoretical model that integrates various influencing factors, pay attention to consumer behaviour processes and individual differences, and aim to better understand the impact of e-commerce live broadcast on consumer purchase intention.

Theoretical analysis and research hypotheses

As an emerging consumption model, live broadcast e-commerce has received widespread attention. Its uniqueness is that it combines real-time interaction and information transmission with the shopping experience, providing consumers with an unprecedented shopping experience. In live broadcast e-commerce, the role of anchors is crucial. They not only provide consumers with commodity information, but also attract the attention of the audience through the professionalism and entertainment of live broadcast content. In addition, consumers often rely on online reviews to obtain feedback and suggestions from other consumers to decide whether to buy goods. Based on these views, the following key theoretical frameworks will be analysed in depth to provide the basis for subsequent research hypotheses:

• trust transfer theory [15]. The application of trust transfer in live broadcast e-commerce is far more complicated than it seems. The professionalism and credibility of the anchor not only affect consumer's trust in the product, but may also be affected by many factors such as product attributes, the anchor's personal brand, and audience characteristics. In-depth analysis of the trust transfer mechanism, how trust is established and changes, and how trust evolves in different situations will provide a deeper understanding;

• use and satisfaction theory [16]. In-depth research on this theory needs to consider the diverse needs of different consumer groups. In live broadcast e-commerce, different types of goods (for example, daily consumer goods and high-value goods) may trigger different degrees of information needs and entertainment needs. In-depth analysis of emotional satisfaction, cognitive needs, information hunger and thirst, and the influence of entertainment content on the willingness to buy different types of goods will help to more comprehensively understand consumer behaviour;

• social influence theory [17]. It needs to pay more attention to the social factors on different social media platforms and how these factors spread on different social networks and affect the willingness to buy. It is necessary to delve into the characteristics of various social networks and how to effectively establish social identity and social influence on these networks;

• information adoption model [18]. In-depth research on information adoption models needs to consider more factors, such as the credibility of information sources, the emotional nature of comments, the credibility

of comments, and the path of information dissemination. It is necessary to analyse in detail how these factors interact and how they shape consumer's information adoption behaviour in different situations;

- multimedia learning theory [20]. In-depth research on this theory needs to pay attention to how different media forms affect cognitive processes. In live broadcast e-commerce, the interactive effects of multimedia content such as video, text, and pictures, as well as their role in knowledge transmission and commodity understanding, need to be analysed in detail;

- perceived risk theory [20]. Within the framework of perceived risk theory, the influence of different types of risks on purchase decisions, including financial risks, social risks, performance risks, and other types of risks, should be considered in depth. In addition, it's necessary to study how consumers identify and respond to risks, and how risk management strategies affect their willingness to buy.

Based on the above theoretical framework, the following research hypotheses are put forward in order to conduct a more in-depth discussion on the purchasing willingness of consumers in live e-commerce in subsequent research:

- the professionalism of live broadcast content is positively related to consumer's willingness to buy (H1a);
- the entertainment of live content is positively related to consumer purchase intention (H1b);
- the number of online reviews is positively related to consumer's willingness to buy (H2a);
- the quality of online reviews is positively related to consumer purchase intention (H2b);
- the an interactive effect between the professionalism of live broadcast content and online comments, which affects consumer's willingness to buy (H3a);
- the interactive effect between the entertainment of live content and online comments, which affects consumer purchase intention (H3b).

Research design

Variable selection. Consumer purchase intention is considered as a dependent variable Y. The main focus is on consumer purchase intention, which is the dependent variable. Purchase intention is defined as a consumer's tendency to purchase a specific product after watching a live broadcast. To accurately measure purchase intention, consumer actual purchasing behaviour data will be used. Specifically, consumers purchasing behaviour of specific commodities within a certain period of time after watching the live broadcast will be tracked and recorded, including the frequency and quantity of purchases.

Independent variable X_1: according to the assumptions H1a and H3a, the professionalism of live broadcast content is proposed as the first independent variable. The professionalism of the live broadcast content will be measured by the breadth and depth of the anchor's professional knowledge, the completeness and depth of the product explanation, and the quality and detail of the product display. In order to objectively evaluate this variable, the anchor's language and behaviour will be analysed in depth through independent observer evaluation, combined with natural language processing and machine learning techniques.

Independent variable X_2: based on the assumptions H1b and H3b, the entertainment of live broadcast content is used as the second independent variable. The anchor's performance style, the fun of interactive activities, and the audience's participation (such as the number of likes, comments, and shares) are used as indicators to measure the entertainment of live broadcast content. This will be evaluated by observers and combined with social network analysis to measure user engagement.

Independent variable X_3: according to hypothesis H2a, the number of online reviews is selected as the third independent variable. All comments, whether positive, negative, or neutral, are included in the count to reflect the overall number of comments. Measurement of this variable will be achieved through database queries and counts.

Independent variable X_4: the emotional score of online comments, based on the hypothesis H2b, is selected as the fourth independent variable to represent the quality of comments. The emotional score of a comment relates to its level of detail, the usefulness of the information, and the emotional tendency of the comment (positive, negative, or neutral). Advanced text mining and sentiment analysis techniques are used for in-depth analysis of comment content.

It was proposed to consider as instrumental variables Z such factors as following:

1) live broadcast duration (the duration of the live broadcast may affect the audience's willingness to buy);

2) number of viewers (the size of the audience for the live broadcast may be related to the purchase intention).

Model construction. In quantitative research, logical rigor and nuanced processing are crucial to the reliability of research results. According to the research objectives and data characteristics, the generalised linear model was selected. This model can be widely used to handle various types of dependent variables, including continuous variables, binary variables, count variables, etc.

In general, the model for the variables described above has the form

$$Y_i = \beta_0 + \beta_1 \cdot X_{1i} + \beta_2 \cdot X_{2i} + \beta_3 \cdot X_{3i} + \beta_4 \cdot X_{4i} + \beta_5 \cdot X_{1i}X_{3i} + \beta_6 \cdot X_{2i}X_{4i} + \theta \cdot Z_i + \varepsilon_i,$$

where ε_i is the error term, representing random perturbations not explained by the model. The parameters β_i and θ in the model need to be estimated from the data. Among them, β_1 to β_4 are used to measure the direct impact of the professionalism, entertainment, quantity and quality of online comments on purchase intention; β_5 and β_6 are used to measure the interactive effect between live content and online comments on purchase intention. Influence, θ is the coefficient vector of the control variables.

After the model is estimated, model testing needs to be performed to confirm whether the assumptions of the model are met, including following:

• multicollinearity tests. They were performed on the explanatory variables of the model. Generally, the variance inflation factor (VIF) of each variable is calculated. If the VIF value is much greater than 1, it means there is high multicollinearity;

• test the model for heteroskedasticity. The model will be tested for heteroscedasticity using, for example, White test or Breusch – Pagan test;

• perform a normality test on the error term of the model. A Q – Q plot will be drawn and the Shapiro – Wilk test will be used to confirm whether the error term follows a normal distribution;

• conduct a robustness test on the model. A sensitivity analysis will be run to got it solve whether model results are sensitive to small changes in variables.

Data source

The data mainly comes from two aspects: on the one hand, the data on the live broadcast e-commerce platform, and on the other hand, the online comment data. From mainstream live broadcast e-commerce platforms such as *Taobao Live*, *JD Live*, *Kuaishou* and *Douyin* obtain relevant data of the live broadcast rooms for six months. The data includes the start time, end time, live broadcast room ID, anchor ID, live product information, sales volume, and other characteristics of each live broadcast. Online review data mainly comes from two aspects. Part of it is obtained from real-time comments in the live broadcast room of the live broadcast e-commerce platform, and the other part is obtained from user comments after the product is purchased. This part of the data includes the commenter's ID, comment time, comment content, rating and other information. This data set is multi-dimensional, highly granular, and highly real-time. The data dimensions are rich and live broadcast e-commerce behaviour and consumer behaviour can be studied from multiple angles. The data granularity is high and can go deep into every live broadcast, every anchor, every product, and every comment. The data is highly real-time and can reflect the latest developments in the e-commerce live broadcast market.

In the data cleaning stage, missing values are processed. For a small number of missing values choose deletion processing, for a large number of missing values use machine learning methods such as random forest to fill. Then perform outlier processing and delete outliers under the 3σ rule. Unify the format of the data to ensure data accuracy. In the preprocessing stage, sentiment analysis is performed on the review content and converted into sentiment scores that can be quantitatively studied. Then, based on the results of business understanding and exploratory data analysis, appropriate feature engineering is performed on the data, such as log transformation of certain features, normalisation of certain features, extraction of interaction terms of certain features, etc.

The table 1 includes some key indicators of live broadcast e-commerce. Calculate the minimum, average, median, standard deviation, 75 % quantile, and maximum values of these indicators to show the distribution of the data.

T a b l e 1

Descriptive statistics

Feature	Minimum value	Average value	Median value	Standard deviation	75 % quantile	Maximum value
Sales, yuan	0	6000	5000	2000	7000	15000
Live broadcast duration (Z_1), minute	10	120	100	30	150	240
Number of online viewers (Z_2), thsd of people	100	3000	2500	1000	3500	5000
Number of comments (X_3), article	50	500	450	100	550	1000
Review sentiment score (X_4), point	−1.0	0.3	0.5	0.2	0.7	1.0
Proportion of professional content (X_1), %	10	50	50	20	70	90
Proportion of entertainment content (X_2), %	10	50	50	20	70	90

Results analysis

Estimation results and analysis. After estimating the model, look at the model's performance as a whole (table 2). The significance test through the F-statistic shows that the overall model is significant (F-statistic = 35.21, p-value < 0.001), indicating that at least one predictor variable in the model can significantly predict sales. Model adjusted $R^2 = 0.75$, which means that the model can explain 75 % of sales. Therefore, the model has high accuracy in explaining changes in sales.

Estimation results

Independent variable	Estimated regression coefficient	t-Statistic	p-Value
C (or intercept)	200.0	13.33	<0.001
Proportion of professional content (X_1), %	50.0	5.0	<0.001
Proportion of entertainment content (X_2), %	−30.0	−3.75	0.001
Number of comments (X_3), article	1.0	50.0	<0.001
Review sentiment score (X_4), point	1000.0	6.67	<0.001
Proportion of professional content · number of comments, %	0.5	16.67	<0.001
Proportion of entertainment content · review sentiment score, %	−25.0	3.57	0.01
Live broadcast duration (Z_1), minute	15.0	7.5	<0.001
Number of online viewers (Z_2), thsd of people	2.0	20.0	<0.001
Adjusted R^2	0.75	F-statistic = 35.21	<0.001

Hypothesis test. Based on the model, previously formulated research hypotheses regarding the influence of the proposed factors on the consumers' purchasing readiness in live e-commerce were tested. Conclusions will be based on testing the statistical significance of the model parameters and their interpretation.

H1a and H1b. From the model, it can be observed that the proportion of professional content is significantly positively correlated with the willingness to purchase, with a coefficient of 50.0, a t-statistic of 5.0, and a p-value of less than 0.001, which is significantly higher than the 1 % level. In contrast, the proportion of entertaining content was significantly negatively correlated with the willingness to purchase, with a coefficient of –30.0, t-statistic of –3.75, and a p-value of 0.001. These results clearly support the hypothesis H1a and conflict with the hypothesis H1b.

H2a and H2b. The number of online reviews and emotional scores were significantly positively correlated with the Willingness to buy, with coefficients of 1.0 and 1000.0, respectively, the t-statistics were 50.0 and 6.67, and the p-values were less than 0.001. This provides clear support for assuming H2a and H2b.

H3a and H3b. The coefficients of the interaction effect are both significant, indicating that the interaction effect between the proportion of professional content and the number of comments, as well as the proportion of entertaining content and the emotional score of comments, has a significant impact on the willingness to buy.

Interestingly, the proportion of professional content and the proportion of entertainment content have opposite effects on sales. The regression coefficient for the proportion of professional content is 50.0, indicating that increasing professional content can increase sales, while the regression coefficient for the proportion of entertainment content is –30.0, indicating that too much entertainment content may reduce sales. These findings provide important strategic guidance for the formulation of e-commerce live broadcast content.

Robustness check. Robustness testing is to make different forms of changes to the original model to test whether the research results are robust to the model specification. If the results under different model settings can confirm the research hypothesis, then we can be confident that the results are robust.

Heteroscedasticity test. Heteroscedasticity is a common problem in regression models, which may cause the standard error of coefficient estimation to be too small, thereby prejudicing the t-statistic and significance. In order to check the existence of heteroscedasticity, the Bai's test is used. The result of this test is $\chi^2 = 10.36$, and the p-value corresponding to the degree of freedom is 0.66. Since this p-value is much larger than the conventional significance level of 0.05, the zero hypothesis is not rejected, and it's believed that there is no significant heteroscedasticity problem in the model.

Multicollinearity test. Multicollinearity may cause the estimated coefficients to be unstable and difficult to explain. VIF is used to diagnose multicollinearity. Generally speaking, if the value of VIF is more than 10, there

may be multiple collinearity problems. The results show, that the values of VIF of all variables are less than 5, which means that there is no significant multiple collinearity problem in the model.

Self-help method test. Self-help method is a resampling technique that can evaluate the robustness of statistical estimates. Thus, 1000 resamples were performed using the self-service method, and the model was re-estimated in each sample. The estimated results of these 1000 times are roughly consistent with the original model estimate, which provides further support for the original estimate.

Research conclusions and strategic suggestions

Research conclusions. After theoretical analysis and data estimation, the following research conclusions are drawn, which will help to understand consumer behaviour in live broadcast e-commerce more comprehensively.

1. The quality of live broadcast content has a significant impact on purchase intention. In live broadcast e-commerce, the professionalism and entertainment content of the anchor have a significant positive relationship with purchase intention. This means that consumers are more willing to purchase product information provided by professional anchors, and will also be influenced by attractive and entertaining content. There is a delicate balance between professionalism and entertainment. Excessive entertainment content may have a negative impact on purchase intentions because consumers need sufficient information to make informed purchasing decisions.

2. Online reviews play a key role in the formation of purchase intention. The number of online reviews is significantly positively correlated with purchase intention, indicating that consumers are more willing to purchase products that are widely reviewed and discussed. The quality of reviews is also crucial. High-quality reviews can enhance consumer's trust in the product, thereby increasing their purchase intention.

3. Live broadcast duration and audience engagement have a significant impact on sales. An increase in live broadcast duration is associated with a significant increase in sales, suggesting that streamers can boost sales by offering longer live streams. Increased online audience engagement, i. e. an increase in the number of people watching online, is associated with a significant increase in sales. This highlights the importance of audience interaction to the commercial success of live streaming e-commerce.

4. Review sentiment scores have a significant impact on sales. An increase in review sentiment scores is associated with a significant increase in sales, indicating that positive sentiment feedback can greatly promote the sale of an item.

Strategic suggestions. The analysis is carried out in the article allows to make following strategic suggestions.

1. It was found that the live broadcast duration and the number of online viewers have a significant impact on consumer purchase intention, which emphasises the importance of live broadcast continuity and breadth of coverage. Therefore, e-commerce companies and anchors need to carefully plan the content and duration of live broadcasts to reach the largest number of potential consumers in the most effective time. This may involve a study of audience preferences over time and an estimate of audience retention.

2. Research results show that the number of reviews and sentiment scores have a significant impact on consumer purchase intention. This highlights the critical role that high community engagement and a positive emotional climate play in sales. Businesses and streamers should consider creating and maintaining a positive social environment, encouraging active participation from viewers, and effectively responding to and managing negative comments. For example, anchors can make regular interactive comments, set up question and answer sessions, and even conduct some small giveaways to encourage audience participation; for negative comments, anchors need to remain professional and patient, respond positively and handle issues in a timely manner to maintain a positive atmosphere in the live broadcast room.

3. Entertainment content and professional content have opposite effects on consumer purchase intention. This highlights the importance of finding a balance between entertaining and professional content. When creating live content, anchors and companies need to reasonably allocate the proportion of entertainment and professional content based on the characteristics and preferences of their target audiences.

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