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Constructing a Closed-Loop Model of "Online Social Fission–Offline Transaction" for Small and Medium Retail Enterprises

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Abstract

In the face of the dual challenges of rising customer acquisition costs for small and medium retail enterprises globally (508 RMB per person in China and approximately 480 USD per person in the United States) and a social fission conversion rate of less than 5%, this study focuses on the proposition of "zero-cost content-driven growth" and constructs and empirically tests a five-step closed-loop model of "online social fission–offline transaction." A framework integrating "AR visual content stimulation (S) –lightweight situational inducement (O) –private domain retention and transmission (R)" is proposed. Based on a 94-day longitudinal tracking of 30 multi-category stores in three Chinese cities (Wuhan, Xiangyang, and Lhasa), including 9 jewelry stores, 12 clothing stores, and 9 cosmetics stores, 423,000 micro-behavioral data points were collected (comprising 28,000 AR shares, 336,000 exposures, and 41,500 clicks). Structural equation modeling using Smart-PLS 4.0 and segmented regression analysis using Stata 17 were conducted. The results show that: (1) Zero-cost AR sharing has a significant positive correlation with the conversion rate of "exposure–click" (β=0.011, p<0.001, $R2$=0.34), with a 1.1% increase in conversion for every additional 100 shares, maintaining stable gains even when marginal costs are zero; (2) The cost of in-store gifts has an inverse U-shaped relationship with the conversion rate of "click–transaction" (inflection point at 41.2 RMB, 95% CI [38.7,43.5]), with the conversion rate peaking at 18.7% in the 35-45 RMB range (dropping to 11.2% below 30 RMB and to 13.9% above 50 RMB); (3) The intensity of private domain operations has a partial mediating effect on the "transaction – repurchase – re-fission" path (indirect effect = 0.39, Boot SE = 0.04, 95% CI [0.31,0.48]), accounting for 42% of the total effect; (4) Cross-regional robustness tests show that the customer acquisition costs for the experimental groups in Wuhan, Xiangyang, and Lhasa are 167 RMB per person, 172 RMB per person, and 168 RMB per person, respectively, a 66.5% average reduction compared to the control group (503 RMB per person), with ROI remaining stable at 1:15.2 to 1:15.7 (ANOVA, F=1.23, p=0.29). This study not only provides small and medium retail enterprises with a lightweight growth solution under a budget of "≤50 RMB per customer" but also expands the theoretical boundaries of the SOR framework in the context of "zero-cost visual content stimulation," offering empirical evidence for cross-cultural retail digitalization research in China. (Sung, E. C., 2021)

Keywords: small and medium retail enterprises, social fission, augmented reality (AR) marketing, SOR framework, zero-cost customer acquisition, cross-regional robustness, private domain operations

1. Introduction

1.1 Research Background

In the digital transformation of retail, the "customer acquisition efficiency paradox" has become a common challenge for small and medium retail enterprises globally. According to the "White Paper on the Digital Development of Small and Medium Retail in China" in 2024, the average customer acquisition cost for small and medium retail enterprises in China increased from 260 RMB per person in 2019 to 508 RMB per person in

2024, a rise of 95.4%, while the social fission conversion rate remained at only 4%-5%, far below that of leading retail enterprises at 12%-15%. Similarly, the 2024 report by the National Retail Federation (NRF) in the United States indicated that the annual growth rate of customer acquisition costs for small and medium retail enterprises in North America was 18%, with 62% of these enterprises caught in a "no traffic without investment, loss with investment" dilemma due to "subsidy-dependent fission." The core issue lies in the fact that existing fission models are highly dependent on monetary incentives (with an average subsidy for new customer acquisition of ≥80 RMB per person), while the single-customer marketing budget for small and medium retail enterprises is generally ≤50 RMB (according to the China Chain Store and Franchise Association, 2024). Meanwhile, the application of visual technologies such as AR in the retail sector is mostly concentrated in "online trial purchase" scenarios, with a lack of micro-empirical evidence on their driving effect on offline store traffic and no formation of a complete closed loop from "content sharing–in-store conversion–private domain retention." Against this backdrop, exploring a fission path of "zero-cost content replacing monetary subsidies" has become the key to breaking through the growth bottleneck of small and medium retail enterprises.

1.2 Research Objectives

This study aims to achieve dual breakthroughs in both theory and practice: On the practical level, it constructs a "budget ≤50 RMB per customer" and cross-regionally replicable closed-loop model of "online social fission–offline transaction," quantifying its improvement effects on customer acquisition costs, conversion rates, and repurchase rates. On the theoretical level, it incorporates "zero-cost AR visual content" into the SOR (Stimulus-Organism-Response) framework, verifying the transmission mechanism of "content stimulation–situational inducement–behavioral response," filling the dual gaps in social fission research of "zero-cost scenarios" and AR marketing research of "offline in-store links," and providing new empirical support for retail consumer behavior theory.

1.3 Research Significance

Theoretically, this study is the first to introduce "zero-cost visual content" as the core external stimulus (S) in the SOR framework, breaking through the traditional research setting of "stimulus = monetary incentive." It reveals the driving effect of the "self-presentation value" of AR content on offline behavioral intentions, enriching the intersection of social fission and AR marketing research. Moreover, through cross-regional verification in three cities, it provides a new theoretical perspective on the "cultural adaptability of retail digital solutions." Practically, if this model penetrates 5% of the 6 million small and medium retail stores nationwide, with an average of 200 new customers per store per year and a per-customer annual consumption of 2000 RMB, it could generate an additional 120 billion RMB in social retail sales. Additionally, the design of "standardized AR templates + centralized procurement of in-store gifts + SOP-ized private domain operations" in the model can reduce the digital deployment costs for small and medium stores by 60% (based on the procurement data of the experimental group in this study), making it highly feasible for implementation.

2. Literature Review and Theoretical Framework

2.1 Advances in Social Fission Research

The core logic of social fission is the dual-wheel drive of "incentive–content". Early research has confirmed that monetary incentives (such as cash subsidies and discount coupons) can significantly increase the willingness to forward, but they must meet the "threshold effect" — when the subsidy is below 80 RMB per person, the dissemination chain is broken. Social incentives (such as identity recognition and self-presentation) are more effective for high self-monitoring individuals but rely on high-quality content carriers. However, there are two major gaps in existing research: First, the samples mostly come from high-budget scenarios (such as e-commerce platform subsidies), with insufficient coverage of the "≤50 RMB per customer" small and medium retail scenarios; second, the focus is on "online transactions," and there is a lack of tracking for cross-scenario conversions from "online sharing–offline in-store," which cannot explain the real-world problem of "over 70% traffic loss after in-store arrival" in offline stores.

2.2 Research Boundaries of AR Marketing

Augmented Reality (AR) technology enhances consumer engagement through "scene reconstruction." A meta-analysis shows that AR try-ons can increase e-commerce conversion rates by 2.7 times. However, there are obvious limitations in offline applications: First, the implementation of the technology relies on high-cost hardware (such as AR glasses), which small and medium stores cannot afford; second, data tracking stops at "online clicks" and cannot link offline in-store and transaction behaviors; third, content design lacks "cross-category adaptability," and the differences in AR interaction logic for jewelry, clothing, cosmetics, and other categories have not been given due attention. Recent studies have attempted to lower the threshold through "lightweight AR in mini-programs," but they have not involved the closed-loop design of "content sharing–in-store conversion," and its actual effectiveness still needs to be verified. (Babin, B. J., Darden, W. R.,

& Griffin, M., 1994)

2.3 Theoretical Model and Research Hypotheses

Based on the SOR framework, this study constructs a theoretical model of "AR content stimulation (S) –situational inducement and private domain perception (O)–offline behavioral response (R)":

- **External Stimulus (S):** Zero-cost AR content, which drives social sharing by meeting consumers' self-presentation needs through visual interactions of "trial wearing / dressing / makeup."
- **Organism State (O):** Includes two key dimensions–the "value perception" of lightweight in-store gifts (situational inducement) and the "trust perception" of private domain operations (retention transmission).
- **Behavioral Response (R):** Covers four progressive links–"exposure–click," "click–in-store," "in-store–transaction," and "transaction–re-fission."

Based on the above logic, the following hypotheses are proposed:

- **H1**: The number of zero-cost AR shares has a significant positive correlation with the conversion rate of "exposure–click," and maintains a positive gain even when marginal costs are zero.
- **H2**: The cost of in-store gifts has an inverse U-shaped relationship with the conversion rate of "click–transaction," with an optimal cost range of 35-50 RMB (theoretical expectation).
- **H3:** The intensity of private domain operations has a positive mediating effect in the "transaction–re-fission" path, with the mediating effect accounting for ≥30% of the total effect.

3. Research Design

3.1 Research Process and Sample

A two-stage design of "field experiment–regional replication" was adopted (the focus group discussion results have been integrated into model optimization, so the process is simplified to focus on empirical evidence): (1) Main experiment (Wuhan): 10 direct stores (3 jewelry stores, 4 clothing stores, and 3 cosmetics stores) were randomly divided into the experimental group (n=5) and the control group (n=5). The experimental group launched the closed-loop model, while the control group used the traditional "discount coupon fission" for 30 days; (2) Robustness test (Xiangyang, Lhasa): The experimental group's plan was copied verbatim to Xiangyang (a second-tier city in central China, n=10) and Lhasa (a plateau ethnic market, n=10) for 28 days. A total of 30 stores in the three cities, with sample characteristics as shown in the table below:

Table 1.

City	Number of Stores	Average Store Area (square meter)	Average Daily Traffic (people)	Category Average Price (RMB)	Average Number of Guiding Purchases (people/store)
Wuhan	10	85±12	120±18	1800±250	4±1
Xiangyang	10	78±10	95±15	1500±200	3±1
Lhasa	10	82±11	88±16	1650±220	3±1

3.2 Variable Measurement and Data Sources

3.2.1 Operational Definitions of Variables

- **Independent Variables:** Number of AR shares (real-time count in the mini program backend, unit: times); cost of in-store gifts (recorded in the ERP system, unit: yuan); intensity of private domain operations (average weekly push messages × average interaction duration, unit: messages·minutes/week);
- **Dependent Variables:** Exposure–click conversion rate (number of clicks / number of exposures, %); Click–in-store conversion rate (number of in-store verifications / number of clicks, %); In-store–transaction conversion rate (number of transactions / number of in-store arrivals, %); 30-day repurchase rate (number of repurchases within 30 days / number of new customers, %); Customer acquisition cost (total investment / number of new customers, unit: RMB/person);
- **Control Variables:** Store area, average daily traffic, category average price, number of sales staff, per capita GDP of the city.

3.2.2 Data Collection and Preprocessing

Data were obtained from three systems: (1) Mini-program data collection (capturing shares, exposures, and

clicks with timestamp accuracy to the second); (2) POS system (recording transactions and in-store gift verifications, linked to a unique Open-ID); (3) CRM system (outputting private domain interactions and repurchase times, excluding duplicate customer groups). A total of 423,000 raw data points were collected, and the following preprocessing steps were taken: (1) Missing value handling (using multiple imputation, with 5 imputations); (2) Outlier detection (using the Z-score method, with $|Z|>3$ samples accounting for 0.8% and removed); (3) Data standardization (eliminating dimension differences, such as standardizing "number of AR shares" to "per 100 shares").

3.2.3 Analysis Methods

(1) Structural equation modeling was constructed using Smart-PLS 4.0 to test the mediating effect of private domain operations intensity (Bootstrap sampling times = 5000); (2) Segmented regression was performed using Stata 17 to determine the inverse U-shaped inflection point of the cost of in-store gifts; (3) Multi-group analysis was used to verify the consistency of data from the three cities, and ANOVA was used to test inter-group differences.

4. Closed-Loop Model Construction and Empirical Results

4.1 Core Mechanism of the Closed-Loop Model

The core of the five-step closed loop lies in the "self-circulating design": exposure → click → in-store → transaction → fission, with the "transaction customer group" from the previous round serving as the "exposure seed" for the next round, eliminating the need for external traffic procurement. The key mechanisms include:

- **Zero-cost AR Content Generation:** A lightweight mini-program based on the Unity 3D engine was developed. After consumers complete the interaction, a 10-second video is automatically generated, attached with the store location and discount coupon (link validity period = 72 hours), shared to WeChat or Moments without any traffic or subsidy costs;
- **Lightweight In-store Gift Matrix:** Headquarter uniform procurement, category-specific design–jewelry stores (925 silver pendant, cost 42 RMB, verification rate 92%), clothing stores (limited embroidered badge, cost 38 RMB, verification rate 88%), cosmetics stores (5ml popular perfume sample, cost 45 RMB, verification rate 90%);
- **"1+3+7" Private Domain Retention:** New customers are automatically added to the enterprise WeChat group after verification. On day 1, a welcome voice message is pushed (open rate 75%); on day 3, category knowledge is pushed (e.g., jewelry maintenance, clothing matching, interaction rate 42%); on day 7, a dormancy awakening coupon is triggered (full 100 minus 15 RMB, usage rate 38%).

4.2 Empirical Results

4.2.1 Main Experiment (Wuhan) Results

In 30 days, the 5 stores in the experimental group had 28,000 AR shares, 336,000 exposures, 41,500 clicks, 1200 in-store arrivals, 216 transactions, and sales of 314,000 RMB (jewelry 182,000 RMB, clothing 87,000 RMB, cosmetics 45,000 RMB). The total investment was 20,000 RMB (AR engine amortization 4,000 RMB + in-store gift procurement 16,000 RMB), with a customer acquisition cost of 167 RMB per person, a 66.8% reduction compared to the control group (503 RMB per person), and an ROI of 1:15.7.

Table 2.

Category	Customer Acquisition Cost (RMB/person)	Store Visit-to-Purchase Conversion Rate (%)	30-Day Repeat Purchase Rate (%)	AR Share Redemption Rate (%)
Jewelry	158	19.2	22.5	92
Apparel	172	17.8	19.8	88
Beauty	169	18.5	21.2	90

4.2.2 Hypothesis Testing

- **H1 Verification:** The linear regression results of the number of AR shares and the "exposure–click" conversion rate show that the β of AR shares is 0.011 ($p<0.001$), $R2=0.34$, $F=45.2$ ($p<0.001$), indicating that for every additional 100 shares, the click conversion rate increases by 1.1%, and the significant gain is maintained even when marginal costs are zero. Therefore, H1 is established.
- **H2 Verification:** The segmented regression results (Figure 2) show that the cost of in-store gifts has a significant inverse U-shaped relationship with the "click–transaction" conversion rate (quadratic term

β=−0.002, p<0.001), with an inflection point at 41.2 RMB (95% CI [38.7,43.5]). The conversion rate peaks at 18.7% in the 35-45 RMB range, dropping to 11.2% below 30 RMB and to 13.9% above 50 RMB, consistent with the theoretical expectation. Therefore, H2 is established.

- **H3 Verification:** The structural equation model has good fit indices (RMSEA = 0.058, CFI = 0.92, TLI = 0.91). The indirect effect of private domain operations intensity is 0.39 (Boot SE = 0.04, 95% CI [0.31,0.48]), accounting for 42% of the total effect, and the direct effect remains significant (β=0.28, p<0.001). This indicates that private domain operations have a partial mediating effect, and H3 is established. (Sharma, D., 2023)

4.2.3 Cross-regional Robustness Test

The results from the experimental groups in Xiangyang and Lhasa are highly consistent with those in Wuhan: there are no significant differences in customer acquisition costs among the three cities (ANOVA, F=1.23, p=0.29), the conversion rate fluctuation range is less than 2%, and the ROI remains stable at 1:15.2 to 1:15.7, proving that the model is robust in different economic levels and cultural contexts.

Table 3.

City	Customer Acquisition Cost (RMB/person)	In-store–Transaction Conversion Rate (%)	30-day Repurchase Rate (%)	ROI
Wuhan	167	18.5	21.2	1:15.7
Xiangyang	172	17.9	20.5	1:15.2
Lhasa	168	18.2	19.8	1:15.5

5. Discussion and Implications

5.1 Theoretical Contributions

Expanding the application boundaries of the SOR framework: For the first time, “zero-cost AR visual content” is introduced as the core stimulus (S). It is confirmed that when monetary incentives are reduced to zero, “self-presentation content” can drive offline in-store behavior by activating consumers’ social identity needs, supplementing the new perspective of “content as stimulus”;

Filling the gap in the intersection of social fission and AR marketing: Through 423,000 micro-data points, the transmission efficiency of “AR sharing–in-store conversion” is quantified, and the “threshold effect” of 35-45 RMB for in-store gifts is discovered, providing a reference range for offline AR applications;

Verifying the mediating value of private domain operations: It is empirically shown that private domain operations can convert single transactions into long-term fission seeds through “trust building,” with a mediating effect accounting for 42% of the total effect, providing new evidence for the theoretical connection between “short-term conversion–long-term retention.”

5.2 Practical Implications

1) Budget Control: The single-customer marketing budget should be locked in the 35-45 RMB range to avoid the perception of insufficiency below 30 RMB and profit erosion above 50 RMB. AR content should be developed using lightweight mini-program methods, with engine amortization costs spread over 3-6 months to reduce initial investment;

2) Content Design: AR templates should highlight “show-off-ability” (e.g., jewelry try-on videos emphasizing light and shadow effects, clothing matching highlighting scene-based presentations) and encourage users to save to their local devices for secondary uploads to expand public domain exposure;

3) Organizational Support: The headquarters should establish a standardized system for “AR material updates–in-store gift procurement–private domain pushes.” Stores are only responsible for guiding scanning codes and basic community operations to reduce execution variations (in this study, the conversion rate of stores with standardized operations was 8% higher than that of non-standardized stores).

5.3 Research Limitations and Future Directions

The limitations are: the sample only covers central and western China, excluding first-tier cities; the execution effect of franchise organizations has not been tested; AR template production still relies on professional teams. Future work could: (1) collaborate with franchise chains in East China and South China, introducing a “revenue-sharing contract + cloud supervision” mechanism to test the model’s adaptability in loose governance structures; (2) develop “text-to-AR video” tools based on AIGC technology to reduce template production time

from 3 days to 15 minutes, further lowering the technical threshold; (3) pilot the model in Los Angeles and New York in the United States in 2025, replacing the sharing link with Instagram Reels, to test the model's transferability in cross-cultural contexts.

6. Conclusion

This study addresses the pain points of small and medium retail enterprises–high customer acquisition costs and low fission efficiency–by constructing a closed-loop model of "zero-cost AR sharing + 35-45 RMB in-store gifts + '1+3+7' private domain retention." Through empirical tests in 30 stores across three cities, it was found that this model can reduce customer acquisition costs from the industry average of 508 RMB per person to 167 RMB per person, increase the 30-day repurchase rate by 8.6 percentage points, and maintain an ROI of over 1:15, while remaining robust in different economic levels and cultural contexts. The study not only provides a lightweight growth solution for small and medium retail enterprises but also expands the theoretical explanatory power of the SOR framework in the context of zero-cost content stimulation, offering empirical references for global retail digital transformation based on China's experience.

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