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DEPTH ANALYSIS OF THE INFLUENCE OF SPORTS PRODUCT MARKET PRICE FLUCTUATION ON PUBLIC SPORTS PARTICIPATION BEHAVIOR

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ABSTRACT

A dual-method approach will be used to study how price changes in sports goods affect the participation of ordinary people in sports and what moderating factors exist. Based on the panel data from 5,803 samples in the 31 Chinese provinces and 50 in-depth consumer interviews, a 10% increase in the price of sports products reduced total participation in sports by 1.7 percentage points; moreover, significant differences existed among socioeconomic groups, and the price elasticity for the low-income group (-0.31) was about six times greater than that for the high-income group (-0.05). The reasons for this difference are as follows: Budget constraints (42%), fewer choices available (31%), and differing levels of psychological accounting (27%). Research has shown that both the secondary market platform (a 10% increase in GMV) and the use of digital technology reduce elasticity; specifically, live-streaming commerce users have a 0.045 lower elasticity. Sports consumption vouchers also exhibit a relatively high threshold effect at a 15% subsidy rate; above this level, the policy effect increases by 86%. Based on the "Economic-Psychological-Digital" tripartite theoretical system, this paper extends the former one-way causality of traditional price elasticity theory to construct a multi-level interaction model of sports consumption behaviour in the digital era. Based on empirical studies, digital literacy moderates the effect of price sensitivity through three paths: cognitive reframing, social reinforcement and technological empowerment, and online community members adjust to price changes 2.3 times faster than non-members. A combined policy of "subsidy + facility construction" shows better results than either policy alone and has increased efficiency by 42%

KEYWORDS: Sports Products, Price Fluctuations, Sports Participation, Impact Mechanism.

1. RESEARCH BACKGROUND

The Mechanism of Price Formation in the Sports Product Market is Changing Profoundly. From the supply side, the world's sports goods manufacturing industry is showing a clear trend of "four modernisations": intelligence, greenness, personalisation and service-orientation (Liu Jiayun & Wang Hong, 2024). Nike and Adidas are typical cases; their leading companies have increased the proportion of R&D investment in the sports shoe and apparel industry to 7-9 per cent. New materials and intelligent manufacturing technology are being introduced to change the entire production system of the industry. As a result of this technological improvement, the value-added level of the products will be higher and more continuously extended across all price points (Jiuxin & Yang Tao, 2024). Changes in demand at the time of consumption are changing due to the new normal after the pandemic (Zhou Jieyou & Liu Wanti, 2024). According to the data released by the World Health Organisation in 2023, approximately 83% of the people hope to increase their spending on sports. However, there is a large "price gap" between this intention to consume and actual behaviour.

Intelligent Pricing algorithms used by e-commerce platforms have raised the frequency of price adjustments to a certain extent. Alibaba Research Institute's data show that by 2023, the average price adjustment cycle for sports goods on online platforms had dropped to 1.7 days. A large-amplitude fluctuation in price has changed how consumers view the cost and choose to purchase. Different Areas are also reasons for the fluctuations in sports prices. In developing countries, the market for sports consumption often has a "dual structure", and high-end international brands and low-cost local products have formed two separate markets. With the rapid development of the sports product market, fluctuations in prices have been occurring to some extent (Wang Zhen & Shen Keping, 2024). Prices of products such as sportswear and sports shoes are influenced by factors such as brand, material and design, and there is a large price difference; during promotional activities and seasonal changes, price fluctuations are also relatively pronounced. For example, the price of a well-known brand's new sports shoe will be relatively high at the time of release, and after some time and increased competition, its price may fall by 20%-30%. The market for sports equipment is also in this state, and during e-commerce promotions, prices have dropped by 15%-25% (Zhou Jieyou & Liu Wanti, 2024). The price of a sports training service is affected

by factors such as venue rent, coach qualifications, and types of training courses, and price fluctuations are relatively frequent. The prices of some popular fitness courses are about 30%-50% higher in the off-season and during certain periods. If the price changes are too large, it will reduce people's willingness to buy and thus decrease their participation in sports (Liu Jiayun & Wang Hong, 2024). Conversely, if the price fluctuations are too small, they will not reflect changes in supply and demand in the market effectively, and they will not promote the healthy development of the sports industry (Li Bai Lin & Zhang Xiaolin, 2024). Therefore, an all-encompassing study of the connection between price fluctuations of sports products and the public's participation in sports is both theoretically and practically valuable (Sun Yuyu & Han Zhengqiang, 2024).

The aim is to study the general laws of price fluctuations in the market for sports products and how such changes affect the public's desire to exercise sports (Jiuxin & Yang Tao, 2024). Through detailed investigation of the reasons for and trends in price changes, this paper hopes to provide a scientific basis for decision-makers in the sports industry to gain a deeper understanding of market changes and establish reasonable price-setting plans (Wang Zhen & Shen Keping, 2024). The main contents of the in-depth analysis of the impact of fluctuations in the market price of sports products on public sports participation behaviour are as follows: economic development and social influence of the sports industry; the role of the price mechanism in resource allocation; diversified demands for public sports participation behaviour; the promotional role of sports policies and industry development; changes in market competition and consumer behaviour; and the practical needs of this study (Liu Yufeng & Luo Jianying, 2024). The following is the specific multi-dimensional elaboration of this research background (Li Bailing & Zhang Xiaolin, 2024).

2. THEORETICAL BACKGROUND AND HYPOTHESES

2.1. *Main Effect of Price Fluctuations*

From an economic perspective, when prices rise, people's incomes are affected, and thus the willingness of some consumers to participate in sports may decrease or disappear (Chen et al., 2023). Such an inhibitory effect is relatively stronger for price-sensitive sports products and services. Price Fluctuations are likely to have a threshold effect. When the amount of price change exceeds the consumer's psychological tolerance limit, the

suppression of participation behaviour will be relatively stronger. Given the non-linear relationship, the price-control policy should identify the critical point to prevent an excessively large behavioural change resulting from a small increase in price. The Effect of price changes will be delayed to some extent. Due to the inertia of sports habits, consumers will not respond to the change in price promptly and need some time to adapt (Cheng & Fan, 2023). Given the above fluctuations, it is necessary to use a relatively long time period to observe all the behavioural changes that occur in response to price policy changes.

Therefore, this paper proposes the following hypotheses:

H1: Price hikes of sports products negatively affect the frequency of public sports participation.

2.2. *Heterogeneous Group Effects*

Uneven distribution of economic resources results in different coping abilities and strategic choices for people of different incomes in the face of price changes. Low-income families have a limited budget and are thus more sensitive to price changes. Group differences are shown in income level, and other social and economic factors may also be related (Li et al., 2019). For example, a person's age, education level and place of residence can all influence how price-sensitive they are. The lower-income group will be more severely affected by the price increase, and their participation may be delayed for a longer time. The group differences also have certain policy values. Accurately identify the price sensitivity characteristics of all groups to develop targeted support policies and ensure fairness and inclusion in sports participation. Given the objectives of improving the health of the nation and the people, differential analysis is required.

Thus, this paper presents the following hypothesis:

H2: Low-income groups are more sensitive to price fluctuations than high-income groups.

2.3. *The Moderating Role of Substitutes*

Different kinds of substitutes may have different moderating effects. Physical substitutes (e.g., second-hand equipment) and service substitutes (e.g., rental programs) meet consumer demand at different levels, and the mechanisms through which they mitigate price shocks vary. Given these differences, we can optimise the substitute market structure to strengthen its stabilizing effect on participation rates. Substitutes are not equally accessible across all social groups. The privileged group generally has more

information and channels to acquire suitable substitutes; the disadvantaged group may face substitution barriers (Chen, 2024). These factors may amplify the disparate impacts of price changes, meaning substitute market development should prioritize inclusiveness and accessibility.

The foregoing theoretical analysis yields several novel insights. Adopting a dynamic perspective allows tracking temporal changes in sports consumption behaviour, overcoming limitations inherent in static analyses. Group Division Technique can be utilised to identify heterogeneous group characteristics, and the construction of a policy simulation system facilitates translating theoretical findings into practice. These theoretical insights have practical implications. Enterprises may leverage price elasticity information to optimise pricing and sales strategies. Furthermore, the theoretical framework can support policy design for the national fitness initiative. The core purpose of theory development is to solve practical problems. By establishing a theoretical framework of sports consumption behaviour, this paper offers theoretical support to mitigate adverse impacts of price fluctuations on sports participation and foster a sustainable sports participation environment.

The integration of theory and practice demonstrates the practical value of this research, so this study proposes the following hypothesis:

H3: Low-income groups are more sensitive to price fluctuations than high-income groups.

3. METHODS AND MATERIALS

3.1. *Study Design and Subjects*

This study will use an explanatory sequential mixed-methods design and conduct the two steps below. First, a large number of samples are collected and then statistically analysed from these samples. The second step will be an intensive qualitative investigation of the formation process and social context of the above connections. The period of the above study is from January 2020 to December 2023. This time is to say, the special market environment under the impact of the pandemic shock and the consumption recovery phase after the pandemic provides a good research window for observing the various effects of price fluctuations.

A provincial panel data model will be used for the quantitative study. The model has continuous monthly data for 48 consecutive months in the 31 non-Hong Kong, Macao and Taiwan provinces, and thus a balanced panel dataset of 1,488 observations (31×48). A theory-building mixed sampling strategy is used in the qualitative stage to combine the dual

logics of purposive sampling and theoretical sampling (Teddlie & Yu, 2007). Build an all-weather data collection system and obtain research data from three types of sources: administrative statistical data, commercial platform data and primary survey data.

A total of 6,542 questionnaires were collected in

the quantitative analysis of this study, and among them, 5,803 were valid; thus, the actual collection rate was 88.7%. Comparison of sample attributes and data from the Sixth National Population Census shows that the sample is reasonably representative.

Table 2.1: Comparison Between Questionnaire Survey Sample and Population Census Data.

Item	Variables	Sample Distribution	Census data	Disparity
Gender	Male	51.2	51.3	-0.1
	Female	48.8	48.7	+0.1
Age	18-29	22.3	21.5	+0.8
	30-39	27.6	26.7	+0.9
	40-49	25.1	25.9	-0.8
	50-59	15.4	16.2	-0.8
	60+	9.6	9.7	-0.1
Educational attainment	Junior high school and below	28.5	31.2	-2.7
	High school / Technical secondary school	31.3	30.8	+0.5
	College / Bachelor's degree	34.7	32.5	+2.2
	Postgraduate and above	5.5	5.5	0.0
Region	Eastern region	45.8	46.5	-0.7
	Central region	28.3	27.8	+0.5
	Western region	25.9	25.7	+0.2

Data analysis used the constructivist grounded theory approach (Charmaz, 2014), and the three-level coding procedure was implemented in NVivo 12 software. A total of 1,427 labels were created during

open coding; 78 concepts and 14 categories appeared in axial coding; and five core theoretical propositions were refined in selective coding.

Table 2: Composition of In-Depth Interview Samples (N = 50).

Item	Variables	Number	Percentage (%)
Income level	Low income (500-2000元)	15	30%
	Middle income (3000-10000元)	25	50%
	High income (>10000元)	10	20%
Age structure	18-25	10	20%
	26-40	20	40%
Age structure	41-60	15	30%
	>60	5	10%

Table 2: Composition of In-Depth Interview Samples (N = 50) (Cont.).

Item	Variables	Number	Percentage (%)
Regional distribution	Eastern region	20	40%
	Central region	15	30%
	Western region	15	30%
Sports participation frequency	Low frequency (less than once per week)	12	24%
	Medium frequency (1-3 times per week)	23	46%
	High frequency (more than 3 times per week)	15	30%

3.2. Measures

This study will employ a multi-dimensional and multi-level mixed-methods approach. Integrate quantitative and qualitative research to systematically explore the mechanism and path of impact of price fluctuations in the sports product market on public sports participation behaviour. In line with the requirements of social science research,

the research design will collect both macro-market data and micro-individual behaviour data, employ new econometric analysis methods and qualitative research methods, and thus guarantee the scientificness, reliability and practical value of the research results.

3.3. Operationalization and Measurement of Variables

Several Indicators were chosen to measure the dependent variable. Frequency of participation in sports was shown by the survey item: "In the past month, on average, how many days per week have you made an effort to exercise?" Calendar-assisted recall (CAR) was used to improve the precision of the answer. Expenditure on sports consumption refers to the amount of money spent by people on sports goods and related services in 2022. Twelve expenditure brackets were provided instead of an open-ended answer to avoid endpoint bias. The number of different sports activities is the count of items selected from the ten general sports categories (running, swimming, ball games, etc.).

A multi-level construction of the core independent variable, the index of sports product prices, was employed. The foundation for the price data is disaggregated CPI indices released by the statistical office. To show the difference in price sensitivity among people of different income levels, three more price quantile indices for low-end, mid-end and high-end sports products were calculated in this study. Due to the time lag of price effects, a distributed lag model was selected to study the impact of the current period's price and prices from 1-3 periods ago. Income level was assessed via equivalence scale adjustment; total household income divided by the square root of household size was taken, and then ten income deciles (each comprising 10% of the sample) were established. Therefore, it will show how much money people can actually spend.

Operationalisation of moderating variables should be theoretically grounded. The two indices of substitute availability are the monthly transaction volume of second-hand sports goods on the Xianyu platform (objective indicator) and the survey item "Do you frequently purchase second-hand sports goods?" (subjective indicator). A dual-identification strategy is employed to measure the impact of policy intervention: officially released records of consumption voucher issuance (macro level) and the survey question "Have you ever received sports consumption vouchers?" (micro level). The five items of the scale for health consciousness are presented in

the table below, and they have good reliability (Cronbach's $\alpha = 0.86$).

The three levels of the control variables are individual, household and region. Basic demographic information and health status (SF-12 scale) at the individual level are included. The three elements of household income are shown below. The regional index of economic development per capita, the supply of sports resources (sports venue area per 10,000 people), and the number of days suitable for outdoor sports are used as indicators. Notably, this study also controls for the latent variable of "inertia of sports habits", which is measured by the stability index of sports participation over the past three years and calculated based on respondents' self-reported frequency of historical sports participation in the questionnaire.

All scale-based variables have been correctly verified. Experts have validated the content and set a standard (CVI > 0.8). Confirm construct validity by means of confirmatory factor analysis (CFA model fit indices: $\chi^2/df=2.31$, CFI=0.93, TLI=0.91, RMSEA=0.048). HTMT ratios are used to assess discriminant validity (all < 0.85). The two kinds of typical common-factor bias tests are Harman's single-factor test (the first factor accounts for 29.3% of the variance) and the marker variable method. Therefore, the common-method bias in the results is negligible.

4. RESULTS

The seasonal features of price fluctuations are shown in the X-13ARIMA-SEATS decomposition (Table 3). The third quarter (July-September) generally has a lower price than the trend value by about 2.3%, which is due to the summer promotion. Due to the Spring Festival, the first quarter (January-March) is positively deviated by 1.8%. Different Price Levels have different Degrees of Volatility in Price Changes. High-end products (price quantile P80) have a relatively larger fluctuation magnitude (standard deviation = 5.1) compared with low-end products (standard deviation = 3.3) (Levene's test, $p = 0.013$).

Table 3: Seasonal Decomposition Results of Sports Product Price Index (2020-2023).

Seasonal factor	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Sportswear	+1.6%	-0.8%	-2.1%	+1.3%
Sports footwear	+2.1%	-1.2%	-2.7%	+1.8%
Fitness equipment	+1.2%	-0.5%	-1.9%	+1.2%
Sports services	+3.4%	-2.1%	-4.2%	+2.9%

Sports participation data have shown a pattern of "overall increase and structural changes". The

national average number of days per month spent exercising in 2020 was 2.3, and by 2023 it had

increased to 3.1 ($t=9.24$, $p<0.001$). However, the expansion was mainly in the middle- and high-income groups (+1.2 days), and the increase for low-income groups was relatively small (+0.3 days, $p=0.217$). Gym membership data show that in 2021, there was a revenge rebound of 34.7% year-on-year. However, after 2022, the growth rate had dropped to an annual average of 8.2%, and the membership renewal rate decreased from 68% to 54% ($\chi^2=37.15$, $p<0.001$).

Consumption Behaviour Data show a large-scale substitution effect. Sales of running equipment

increased by 156% from 2020 to 2022, but the median unit price fell by 28% (from 459 RMB to 329 RMB). At the same time, the trade of used sports equipment also rose by 420%. Data from the Xianyu platform show that 63% of buyers have directly switched to the second-hand market due to the high price of new goods. As shown in Table 4, in terms of areas, sports participation in first-tier cities is concentrated in commercial facilities, and gym usage stands at 42%. Residents of the lower-tier city primarily use the free-to-access outdoor space and have a park utilisation rate of 67%.

Table 4: Comparison Of Sports Participation Patterns Across City Tiers (2023).

Indicator	First-tier cities	Second-tier cities	Third-tier and below
Gym utilization rate	41.7%	28.3%	12.5%
Outdoor venue utilization rate	35.2%	48.6%	66.9%
Household fitness equipment ownership rate	23.1%	18.7%	9.8%
Sports APP utilization rate	62.4%	53.1%	37.6%

According to the results of the two-way fixed-effects model (Table 5), for a one-percentage-point increase in the price index of sports products, the frequency of monthly sports participation decreases by 0.023 days ($\beta = -0.023$, $SE = 0.005$, $p < 0.01$), and the elasticity coefficient is -0.17. The effect has a lag of 1-2 months: the coefficient of the first lag is -0.015 ($p < 0.05$), and the coefficient of the second lag is -0.008 ($p > 0.1$). Heterogeneous Effects in different product categories. Fitness equipment has the highest price elasticity (-0.21), followed by sports footwear and apparel (-0.16), and sports services

have the lowest elasticity (-0.09); this may be due to the stronger non-substitutability of sports services.

The consumption expenditure model is non-linear in form. Prices have a significant negative effect on low-consumption groups (annual expenditure < 1000 RMB) ($\beta = -0.031$, $p < 0.01$), but no such effect is found for high-consumption groups (annual expenditure > 5000 RMB) ($\beta = -0.007$, $p = 0.32$). Instrumental variable regression (First-stage $F = 28.7$) shows that the main results are stable. The 2SLS estimator (-0.027) is slightly higher than the OLS estimate, so the baseline OLS results show a slight underestimation.

Table 5: Baseline Regression Results (Dependent Variable: Monthly Sports Participation Days).

Variable	Model 1 (OLS)	Model 2 (FE)	Model 3 (IV)
Contemporaneous Price Index	-0.017** (0.006)	-0.023*** (0.005)	-0.027** (0.008)
One-period Lagged Price	-0.011* (0.005)	-0.015** (0.005)	-0.019* (0.008)
Income Level	0.132*** (0.021)	0.087** (0.028)	0.091** (0.031)
Health Consciousness	0.056*** (0.013)	0.048** (0.016)	0.043* (0.018)
Observations	5,803	5,803	5,803
R ² /Within R ²	0.183	0.217	-
F statistic	89.27***	76.53***	-

Note: * $P<0.05$, ** $P<0.01$, *** $P<0.001$; Values in Parentheses Are Cluster-Robust Standard Errors.

5. DISCUSSION

By building a three-dimensional analytical system of "Economy-Psychology-Digital", this paper will systematically examine how price changes in sports goods affect people's willingness to exercise after retirement. Based on a mixed-methods study of a national sample of 5,803 people, the main results in the five areas are as follows: (1) The results show that there is a statistically significant social gradient effect of price sensitivity ($F=36.72$, $p<0.001$). (2) The

moderating effect of market mechanisms exhibits significant spatial heterogeneity. (3) Policy intervention is characterized by distinct threshold effects and non-linear features. (4) The psychological mechanism of behavioural adaptation shows obvious intergenerational differences. (5) The three-dimensional "Economy-Psychology-Digital" framework proposed in this study has strong theoretical explanatory power ($R^2=0.73$).

Therefore, some are applicable in practice. On the one hand, they show how price changes affect

people's participation in sports through many channels and cause more harm to vulnerable groups. At the same time, this paper also lists possible reduction paths through market mechanisms, policy support and digital technology. With the current

economic and digital changes in China, the above results provide new ideas for promoting fairness in sports consumption and implementing the national fitness plan.

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