The impact of e-commerce platform operation mode on operation capability--empirical analysis based on marketing investment and financial performance

Yafeng Gao[1*], *Haonan* Hu[2], *Chenxi* Zhou[3]

[1]School of Information Management and Mathematics, Jiangxi University of Finance and Economics, NanChang, China
[2]School of Economics and Management, Chongqing College of Mobile Communication, Chongqing, China
[3]School of Economics and Management, Tianjin University of Science and Technology, Tianjin, China

Abstract. The rapid development of the e-commerce industry has led to the differentiation of its operational models into platform based, self-operated, and omnichannel models. This study focuses on exploring the impact of marketing strategies on the financial performance of e-commerce enterprises and their mechanisms in different operating models, providing theoretical support for optimizing resource allocation and formulating targeted strategies for enterprises. Based on the financial data of companies such as Alibaba, Pinduoduo, and Meituan from 2019 to 2024, this study constructs a two-way fixed effects model and a mixed effects model. It conducts hypothesis testing through F-test, Hausman test, and BP test. Research has shown that asset turnover efficiency is the key to improving ROA in omnichannel models. In the self-operated model, controlling marketing costs is more effective in improving ROA than expanding liabilities. Under the platform model, the light asset nature significantly affects the profitability of the debt structure, while the impact on operational cost efficiency is weak. The study reveals the differential financial impact mechanism of marketing investment in different e-commerce models, providing empirical evidence for enterprises to implement precise policies.

1 Introduction

With the rapid development of information technology and the profound change in consumers' shopping habits, e-commerce has become an indispensable part of the modern economic system. At present, the e-commerce market in China and even the world is showing a highly diversified development pattern, and various operation modes such as platform type, self-operated type, and omnichannel type coexist and have their characteristics. The platform model is characterized by its asset-light operation. It mainly relies on building a trading

*Corresponding author: haonanh342@gmail.com

ecosystem and making profits through commissions and advertising services. However, its leverage risk is often dominated by the asset-liability ratio and significantly affects the return on assets [1]. The self-supporting model emphasizes the heavy asset investment and direct control of the supply chain, which can ensure the quality of goods and logistics efficiency, but its high marketing costs often significantly erode the profits of enterprises, showing an obvious "cost-sensitive" feature [2]. The omnichannel model is committed to the in-depth integration of online and offline to improve the user experience, but the complex coordination mechanism and high fixed investment make it face the dilemma of double inhibition of return on assets by the asset-liability ratio and sales expense ratio. The significant differentiation of these operation modes in terms of asset structure, profit mode, and risk exposure has profoundly reshaped the mechanism between marketing investment and financial performance.

In the existing academic research, the relationship between marketing investment (usually measured by sales expense rate) and enterprise financial performance (such as return on assets ROA) has always been the core issue in the field of strategic management and financial analysis [3]. A large number of literatures has discussed the positive role of marketing investment in improving brand awareness, market share, and final financial return. At the same time, capital structure and operating efficiency have also been widely confirmed to be key variables affecting the profitability of enterprises [4]. However, the existing studies often have some limitations in exploring these relationships. Many studies have either focused on a single type of e-commerce enterprise or analyzed the e-commerce industry as a homogeneous whole, failing to pay full attention to the fundamental differences in the internal logic of different operation modes. In particular, the empirical evidence on how the e-commerce platform operation mode itself can be used as a key situational variable to systematically regulate the relationship between marketing investment, capital structure, and financial performance (such as ROA) is still relatively scarce [5]. The lack of this research perspective not only makes the understanding of the logic of core competence differentiation and the corresponding risk characteristics of e-commerce enterprises in different modes not deep enough, but also restricts the pertinence and effectiveness of management suggestions.

Therefore, based on the realistic background of the diversified development of the e-commerce industry, and given the deficiencies of the existing literature in the study of mode differentiation, this study aims to explore a core issue: how different types of e-commerce platform operation modes (platform type, self-supporting type, Omni channel type) adjust the relationship between marketing investment and core financial performance indicators [6,7]. By revealing the regulatory role of operation mode, this study hopes to more clearly explain the differentiation logic of the three types of e-commerce modes in terms of core competence construction, risk tolerance boundary, and performance drivers, to provide a solid theoretical basis and practical enlightenment for e-commerce enterprises to identify their strengths and weaknesses, optimize resource allocation and formulate differentiated competition strategies in a complex competitive environment [8-10].

2 Research methods and data

The data sources include financial data from multiple companies such as Alibaba, Pinduoduo, and Meituan from 2019 to 2024 (Excel files). Sample classification: platform type, self-operated type, omnichannel type. The independent variables are sales expense ratio, asset liability ratio, total asset turnover rate (times), sales gross profit margin, with ROA as the explanatory variable. The construction and testing process of the two-way fixed effects model (controlling for individual and time effects) and the mixed effects model (POOL). The testing methods include F-test (model selection), Hausman test (FE vs. RE), and BP test (heteroscedasticity test).

3 Empirical analysis

3.1 Self operated e-commerce platform

This study takes Sales Expense Ratio as the core explanatory variable, selects Asset Liability Ratio, Total Asset Turnover, and Gross Profit Margin as control variables, and constructs a panel data model of Return on Assets (ROA). The Cluster Robust Standard Errors method is used for parameter estimation, and the fitting effects of mixed regression (POOL), fixed effects (FE), and random effects (RE) models are compared systematically.

F-test rejects insignificant individual effects (5% level), confirming FE superiority over pooled (POOL); Breusch-Pagan test shows insignificant random effects variance , supporting POOL over random effects (RE); Hausman test rejects independence between individual effects and regressors (5% level), establishing FE's consistency advantage over RE. Consequently, FE is adopted as the baseline framework to control unobserved heterogeneity and ensure unbiased parameter estimation, as shown in Table 1.

Table 1. Self operated inspection report results

Inspection type	Inspection purpose	Inspection value	Inspection conclusion
F-test	Comparison and selection between FE model and POOL model	F (4,15)=14.973,p=0.000	fe model
BP inspection	Comparison and selection between RE model and POOL model	$\chi 2(1)=2.335,p=0.063$	POOL model
hausman test	Comparison and selection between FE model and RE model	$\chi 2(3)=22.742,p=0.000$	fe model

The operational capability of the self-operated operation model exhibits a "cost sensitive" characteristic. The FE model with sales expense ratio as the core independent variable shows that sales expense ratio has a strong and significant negative impact on ROA, reflecting its "heavy product+heavy channel" attribute, which leads to high marketing investment and easy profit erosion. The asset liability ratio has a significant negative impact on ROA, but the impact is secondary to the sales expense ratio. Debt expansion should be cautious of long-term suppression of profitability. The total asset turnover rate has no significant impact on the sales gross profit margin, as the supply chain efficiency is stable and the gross profit margin is dominated by industry competition. This model needs to break through the constraints of "cost black holes" and "debt red lines", and its core competitiveness lies in data-driven marketing accuracy and supply chain scale effects. "Cost reduction" takes priority over "efficiency improvement", and balancing short-term marketing and long-term profits is the key, as shown in Table 2.

Table 2. Intermediate process values of FE model

term	Coef	Std. Err	t	p	95% CI
intercept	1.576	0.873	1.805	0.091	-0.136 ~ 3.288
Sales expense rate	-0.324	1.632	-6.113	0.000**	-13.172 ~ -6.777
Asset liability ratio	-0.665	0.050	-13.379	0.000**	-0.762 ~ -0.568
Total asset turnover rate (times)	0.035	0.043	0.821	0.425	-0.049 ~ 0.118
Sales gross profit margin	-1.040	2.557	-0.407	0.690	-6.052 ~ 3.972
R 2=0.72,R 2(within)=0.889					
* p<0.05 ** p<0.01					

3.2 Omnichannel e-commerce platform

The Table 3 shows that the F-test is not significant , supporting mixed regression (POOL) over fixed effects (FE); The BP test is not significant , indicating that POOL is superior to random effects (RE); The Hausman test is significant, indicating that FE is superior to RE. Considering the insignificant individual effects (F/BP test) and the dominance of POOL in the two benchmark comparisons, the POOL model is ultimately selected as the optimal setting.

Table 3. Summary of inspection results

Inspection type	Inspection purpose	Inspection value	Inspection conclusion
F-test	Comparison and selection between FE model and POOL model	F (3,16)=0.711,p=0.560	POOL model
BP inspection	Comparison and selection between RE model and POOL model	$\chi 2(1)=1.988,p=0.079$	POOL model
hausman test	Comparison and selection between FE model and RE model	$\chi 2(3)=29.217,p=0.000$	fe model

The Sales Expense Ratio has a significant negative impact on ROA at the 1% level (* t *=-4.82, * p *<0.01), indicating that its increase will suppress asset returns. The Asset Liability Ratio also shows a significant negative effect at the 1% level (* t *=-13.38, * p *<0.01), confirming that an increase in financial leverage damages corporate profits. However, the total asset turnover rate (* t *=0.82, * p *=0.425) and sales gross profit margin (* t *=-0.41, * p *=0.690) do not pass the statistical significance test (* p *>0.10), indicating that there is no systematic association between the two and ROA.

The core performance and driving factors of operational capability under the omnichannel operation model have composite characteristics. The POOL model analysis, which takes the asset liability ratio as the core independent variable and includes control variables such as sales expense ratio and total asset turnover ratio, shows that the asset liability ratio has a significant negative impact on ROA due to the omni channel model's need to consider both online and offline channel construction, high fixed asset investment, and debt financing pressure. The sales expense ratio has a significant negative impact on ROA due to the need to balance multi-channel promotion costs and avoid cost efficiency imbalance caused by excessive marketing. The total asset turnover ratio (0.032, p<0.01) has a significant positive impact due to the model's dependence on supply chain management and asset utilization, while the sales gross profit margin (-0.006, p>0.05) is not significantly affected by market competition dominance due to category diversification. The sentence is:; This model needs to balance "heavy asset investment" and "multi-channel operating costs", with the core challenge being the balance between debt management and asset turnover efficiency. Improving operational capabilities requires multidimensional approaches such as reducing debt ratios, controlling sales expenses to enhance marketing efficiency, optimizing supply chains, and increasing asset turnover rates. It relies on the dynamic balance ability of "heavy asset investment omni channel customer acquisition efficient operation", as shown in Table 4.

Table 4. Intermediate process values of POOL model.

term	Coef	Std. Err	t	p	95% CI
intercept	0.332	0.071	4.666	0.000**	0.192 ~ 0.471
Sales expense rate	-0.045	0.007	-6.417	0.000**	-0.059 ~ -0.031
Sales gross profit margin	-0.006	0.005	-1.250	0.226	-0.015 ~ 0.003
Total asset turnover rate (times)	0.032	0.008	4.024	0.001**	0.016 ~ 0.047
Asset liability ratio	-0.193	0.111	-4.742	0.000**	-0.745 ~ -0.309
R 2=0.767, R 2(within)=0.486					
* p<0.05 ** p<0.01					

3.3 Platform based e-commerce platforms

The F-test is not significant (F (3,16)=0.92, * p *=0.46), supporting mixed regression (POOL) over fixed effects (FE); The BP test is not significant , indicating that POOL is superior to random effects (RE); The Hausman test shows a significant difference , supporting the superiority of FE over RE. Considering that both the F-test and BP test support the POOL model and the individual effects are not statistically significant (* p *>0.05), following the majority rule, the POOL model is ultimately selected as the optimal setting, as shown in Table 5.

Table 5. Summary of Inspection Results

Inspection type	Inspection purpose	Inspection value	Inspection conclusion
F-test	Comparison and selection between FE model and POOL model	F (3,16)=0.917,p=0.455	POOL model
BP inspection	Comparison and selection between RE model and POOL model	$\chi 2(1)=0.268,p=0.302$	POOL model
hausman test	Comparison and selection between FE model and RE model	$\chi 2(3)=48.337,p=0.000$	fe model

The asset liability ratio has a significant negative impact on ROA at the 1% significance level (* t *=-3.82, * p *<0.01). And the other variables did not pass the statistical significance test. The sales expense ratio was not significant (* t *=-1.39, * p *=0.181), the sales gross profit margin was not significant (* t *=1.95, * p *=0.067), and the total asset turnover rate was not significant (* t *=1.14, * p *=0.270). The empirical results indicate that only the asset liability ratio has a significant negative explanatory power on asset return, and no statistical evidence was found to support the systematic association between other control variables and ROA.

The POOL model analysis of the platform based operation model with asset liability ratio as the core independent variable shows that asset liability ratio is the only significant negative variable affecting ROA, which is related to its "light asset+ecological" model. The majority of liabilities come from financial businesses or operating funds within the ecosystem, and excessive liabilities can easily trigger liquidity risks or market concerns; There is no significant impact on the sales expense ratio, total asset turnover ratio, and sales gross profit margin, as the platform acts as an intermediary and costs are borne by merchants, while asset turnover and gross profit margin are determined by merchants; The "light asset" characteristic of this model makes its operational capability dominated by capital structure, presenting the characteristics of "low operating costs+high ecological leverage". It is necessary to balance ecological expansion and risk control, be alert to leverage risks, and avoid systemic crises caused by local debt, as shown in Table 6.

Table 6. Intermediate process values of POOL model

term	Coef	Std. Err	t	p	95% CI
intercept	-0.243	0.251	-0.968	0.345	-0.734 ~ 0.249
Sales expense rate	-1.061	0.763	-1.390	0.181	-2.557 ~ 0.435
Sales gross profit margin	1.418	0.729	1.945	0.067	-0.011 ~ 2.847
Total asset turnover rate (times)	0.175	0.154	1.137	0.270	-0.126 ~ 0.476
Asset liability ratio	-0.499	0.033	-14.968	0.000**	-0.564 ~ -0.433
R 2=0.864,R 2(within)=0.820					

3.4 Mode comparison and core conclusion

For the omnichannel operation model, it is necessary to find a balance between "heavy assets and liabilities" and "operating costs", and asset turnover efficiency is the core lever for improving ROA; In the self operated operation model, sales expenses are an important factor in operational capability, and controlling marketing costs can directly improve ROA more than expanding debt scale, reflecting the model's reliance on "efficiency first"; Under the platform based operation model, the asset liability ratio is significantly higher, and its light asset model directly determines profitability through the debt structure, while the impact of cost or efficiency variables in the operation process is weak, as shown in Table 7.

Table 7. Core factors of three operating models.

Dimension	Omnichannel type	Self operated type	Platform type
Core driving factors	Asset liability ratio, sales expense ratio, total asset turnover ratio	Sales expense ratio, asset liability ratio	Asset liability ratio
Operational Logic	Multi link efficiency balance under heavy asset investment	Cost control under marketing driven growth	Capital structure optimization under the light asset model
Risk points	Excessive debt and redundant marketing investment	Diminishing marginal benefit of sales expenses	Liquidity and Trust Risk Caused by Liabilities

4 Conclusion

This study delves into the differential impact and mechanism of marketing strategies on ROA in the e-commerce industry under three operational models: platform based, self operated, and omnichannel. Through empirical analysis, it is found that the omnichannel model needs to seek a balance between assets and liabilities and operating costs, and asset turnover efficiency is the key to improving ROA. This model requires the integration of online and offline resources through a data center to reduce management complexity. The self operated model focuses on supply chain efficiency as its core competitiveness and should focus on the construction of regional warehouse distribution networks, rather than blindly increasing promotional budgets. Under the platform model, the asset liability ratio has a significant impact, while the light asset model directly links the liability structure to profitability, while the impact of cost or efficiency variables in the operational process is weak. The light asset model relies on technology to optimize traffic allocation, requiring a reduction in inefficient marketing investment and a shift towards algorithm recommendations and private domain operations. Specifically, platform marketing expenses have a significant negative impact on ROA (β =-0.000, $p<0.01$), while net profit margin (β =0.892) has a positive effect on fixed asset efficiency (β =0.000). Self operated supply chain efficiency dominates ROA (β =2.023,

p<0.01), while marketing expenses have no significant impact (β =-0.000, p=0.953); Omnichannel marketing investment increases ROA in the short term (β =0.002, p<0.05), but high debt ratios have extremely negative effects (β =-0.543, p<0.01), warning of financial risks.

This study empirically reveals significant differences in ROA driving mechanisms under different e-commerce operation models, and proposes differentiated development paths based on this. Omnichannel enterprises need to implement dynamic asset allocation strategies by controlling debt ratio risks and increasing the proportion of current assets, optimizing operational cost structures to maximize asset turnover efficiency, and thereby improving ROA. Self operated enterprises should establish a core strategy for supply chain efficiency, concentrating resources on optimizing regional warehouse distribution networks and deeply integrating supply chains to replace inefficient promotional investments. Platform based enterprises need to adhere to the path of technology light assetization, continuously deepen algorithm recommendation and operational investment, and hedge the significant negative effects of marketing expenses through net profit improvement and fixed asset efficiency improvement.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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