

PAPER

The Impact of Mobile Payments on the Financial Management Efficiency of Small and Medium-Sized Enterprises

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2016010775@sjzpt.edu.cn**ABSTRACT**

In recent years, mobile payment technology has rapidly developed and gradually become an integral part of daily economic activities, particularly within small and medium-sized enterprises (SMEs). The widespread adoption of mobile payments has significantly transformed financial management and operational models in SMEs. As vital drivers of economic growth, the financial management efficiency of SMEs is crucial to their survival and development. The extensive application of mobile payments not only facilitates daily transactions but also provides additional data and information support, potentially enhancing financial management efficiency. However, although numerous studies focus on the impact of mobile payments on business operations, there is a gap in the specific examination of their effect on the financial management efficiency of SMEs. Existing research predominantly addresses the impact of mobile payments on the overall market, lacking detailed analysis targeting SMEs. Furthermore, research methodologies often overlook the heterogeneity of user behavior on mobile payment platforms, failing to comprehensively reflect the differential impact on various types of enterprises. This study explores how user utility, user scale, platform profit, and equilibrium price affect the financial management efficiency of SMEs by constructing a theoretical model. It consists of two parts: initially defining financial management efficiency in SMEs and analyzing its influencing factors to update their financial management models. Subsequently, it examines the impact of mobile payment platforms on these factors through empirical analysis and model derivation. The findings demonstrate that mobile payment technology significantly enhances the financial management efficiency of SMEs, offering useful insights for business management and policy-making.

KEYWORDS

small and medium-sized enterprises (SMEs), financial management efficiency, mobile payments, user utility, user scale, platform profit, equilibrium price

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1 INTRODUCTION

In recent years, mobile payment technology has rapidly developed and gradually become an integral part of daily economic activities in society [1–4]. Particularly among small and medium-sized enterprises (SMEs), the widespread adoption of mobile payments has significantly transformed their financial management and operational models [5, 6]. As key drivers of economic growth, the financial management efficiency of SMEs is crucial to their survival and development [7]. The extensive application of mobile payments not only facilitates daily transactions but also provides additional data and information support, which may enhance their financial management efficiency. Therefore, studying the impact of mobile payments on the financial management efficiency of SMEs holds substantial practical significance.

Examining the influence of mobile payments on the financial management efficiency of SMEs not only aids in understanding the specific role of mobile payment technology in business operations but also offers theoretical support and practical guidance for SMEs to optimize their financial management [8–10]. By analyzing the effects of factors such as user utility, user scale, platform profit, and equilibrium price on the financial management efficiency of SMEs, effective strategic recommendations can be provided to business managers, assisting them in leveraging mobile payment technology to enhance their competitiveness [11, 12]. Furthermore, this study can serve as a reference for policymakers, contributing to the establishment of a more robust digital economic environment and promoting the healthy development of small and medium-sized enterprises.

Although numerous studies focus on the impact of mobile payments on business operations, there is still a gap in specifically examining their effect on the financial management efficiency of SMEs [13–16]. Existing research predominantly addresses the impact of mobile payments on the overall market, lacking detailed analysis targeting SMEs [17, 18]. Moreover, current research methodologies often overlook the heterogeneity of user behavior on mobile payment platforms, failing to comprehensively reflect the differential impact on various types of enterprises [19–24]. Therefore, it is necessary to adopt more refined and comprehensive methods to investigate the specific mechanisms by which mobile payments affect the financial management efficiency of small and medium-sized enterprises.

This study develops and applies a theoretical model to examine how factors such as user utility, user scale, platform profit, and equilibrium price impact SMEs' financial management efficiency. Initially, it defines this efficiency and analyzes its determinants to refine SMEs' financial management models. The study further investigates how mobile payment platforms influence these factors. Empirical analysis confirms that mobile payment technology significantly boosts SMEs' financial management efficiency, providing key insights for business management and policy development. This study not only addresses gaps in the existing literature but also introduces new approaches for future studies.

2 CONSTRUCTION AND DERIVATION OF THE THEORETICAL MODEL

Figure 1 illustrates the operational mechanism of mobile payment methods. A theoretical model was further constructed and derived in this study to analyze the impact of mobile payments on the financial management efficiency of SMEs. Firstly, it is assumed that only two major mobile payment platform enterprises exist in the

market, both of which have similar marginal costs and zero fixed costs. In this market structure, the transfer costs between mobile payment platforms are high, leading users to typically choose a single platform for payment operations, forming a single-homing characteristic. Further consideration was given to the impact of these platform enterprises on the financial management efficiency of SMEs. Mobile payment platforms provide fast, secure, and convenient payment solutions, reducing the time costs, information collection costs, transaction risks, and negotiation fees for SMEs during the payment process. Let variable R represent the financial management efficiency of SMEs, and the impact of mobile payment development on the financial management efficiency of SMEs is defined as variable L . Finally, through model derivation, the specific impact of mobile payment development on the financial management efficiency of SMEs was analyzed. In the context of a two-sided market, platform enterprises enhance the overall value of the platform by attracting more users to expand network effects. As the user base of mobile payment platforms grows, platform enterprises can leverage scale effects to reduce transaction costs and improve service quality, thereby further enhancing the financial management efficiency of SMEs. The model hypothesizes a positive correlation between L and R , indicating that an increase in L leads to an improvement in R .

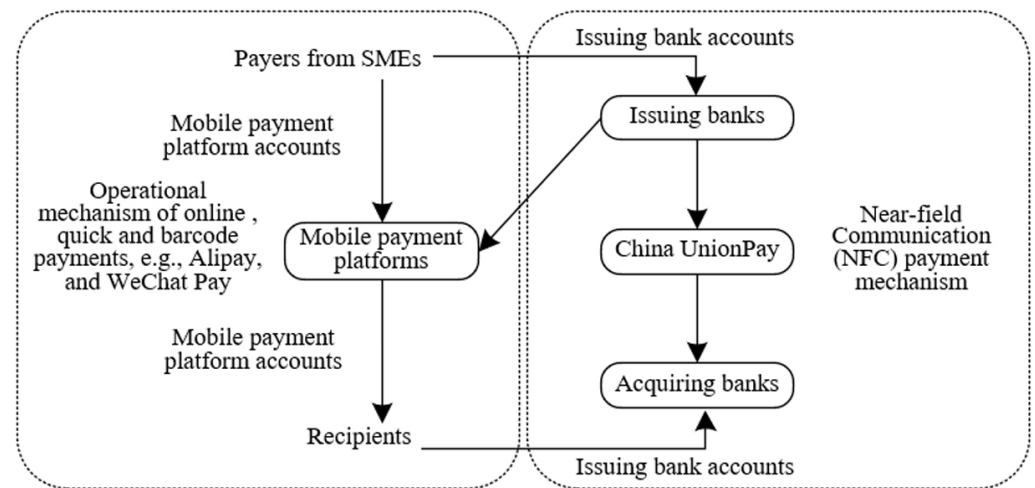


Fig. 1. Operational mechanism of mobile payment methods

2.1 Utility of mobile payment platform users

For the customers of SMEs, mobile payment methods offer greater convenience, shorter payment times, and more secure storage of payment data, thereby reducing the occurrence of transaction defaults. For SMEs, using mobile payment methods eliminates the need for traditional point of sale (POS) machines, reducing equipment costs and increasing the likelihood of successful transactions. This utility brought by emerging mobile payment methods is uniformly represented by L . Assuming the payment services market is an oligopoly with only two competing platforms, one being the emerging mobile payment platform enterprise u and the other the traditional payment platform enterprise k . The cross-network externalities between users on both sides of the two platforms are assumed to be identical, i.e., $\beta_1^u = \beta_1^k = \beta_1$ and $\beta_2^u = \beta_2^k = \beta_2$. Figure 2 illustrates the utility of mobile payment platform users.

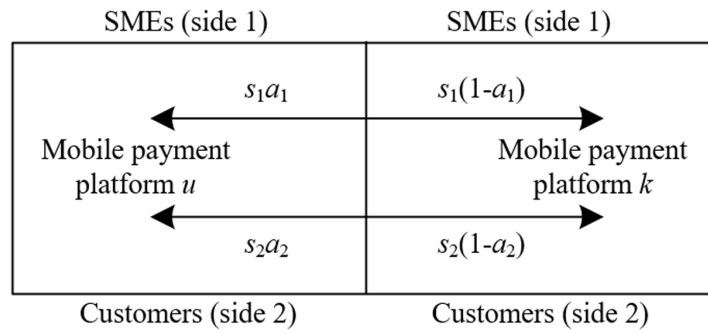


Fig. 2. Illustration of the utility of mobile payment platform users

Assuming the prices charged for SMEs and their customers by the original payment platform u are denoted by o_1^u and o_2^u , respectively, and the prices charged by the mobile payment platform k are denoted by o_1^k and o_2^k . The utility for the customers of SMEs using the emerging mobile payment platform u can be expressed as follows:

$$I_1^u = \beta_1 v_2^u - o_1^u - s_1 a_1 + L \quad (1)$$

$$I_2^u = \beta_2 v_1^u - o_2^u - s_2 a_2 + L \quad (2)$$

For SMEs, the utility of accepting the emerging mobile payment platform k can be expressed as follows:

$$I_1^k = \beta_1 v_2^k - o_1^k - s_1(1-a_1) \quad (3)$$

$$I_2^k = \beta_2 v_1^k - o_2^k - s_2(1-a_2) \quad (4)$$

By solving these four equations simultaneously, the following results can be obtained:

$$v_1^u = \frac{1}{2} + \frac{\beta_1 (v_2^u - v_2^k) + o_1^k - o_1^u + L}{2s_1} \quad (5)$$

$$v_2^u = \frac{1}{2} + \frac{\beta_2 (v_1^u - v_1^k) + o_2^k - o_2^u + L}{2s_2} \quad (6)$$

2.2 User scale of mobile payment platforms

When examining the impact of mobile payments on the financial management efficiency of SMEs, it is necessary to consider the fixed scale of SMEs and their customers in the market. These entities adhere to the single-homing principle on payment platforms, meaning that based on factors such as convenience, cost, and payment security, SMEs and their customers choose one of the two payment platforms. For the emerging mobile payment platform u , as the user experience improves, more customers are likely to join platform u . Similarly, SMEs choose a payment platform based on considerations of cost-effectiveness, security, and transaction success rate. The emerging mobile payment platform u is likely to attract more SMEs due to its lower equipment costs and higher transaction success rates.

Thus, SMEs and their customers either choose to join platform u or platform k , expressed as $v_1^u + v_1^k = 1$ and $v_2^u + v_2^k = 1$. The numbers of SMEs and their customers

are denoted by a_1 and a_2 , respectively, where $v_1^u = a_1$ and $v_2^u = a_2$. Based on the above assumptions, the following can be derived:

$$v_1^u = \frac{1}{2} + \frac{\beta_1(v_2^u - v_2^k) + o_1^k - o_1^u}{2s_1} + \frac{L}{2s_1} \tag{7}$$

$$v_1^k = \frac{1}{2} - \frac{\beta_1(v_2^u - v_2^k) + o_1^k - o_1^u}{2s_1} - \frac{L}{2s_1} \tag{8}$$

$$v_2^u = \frac{1}{2} + \frac{\beta_2(v_1^u - v_1^k) + o_2^k - o_2^u}{2s_2} + \frac{L}{2s_2} \tag{9}$$

$$v_2^k = \frac{1}{2} - \frac{\beta_2(v_1^u - v_1^k) + o_2^k - o_2^u}{2s_2} - \frac{L}{2s_2} \tag{10}$$

$$v_1^u = \frac{1}{2} - \frac{\beta_1(o_2^k - o_2^u) + s_2(o_1^k - o_1^u)}{2(s_1s_2 - \beta_1\beta_2)} + \frac{\beta_1 + s_2}{2(s_1s_2 - \beta_1\beta_2)}L \tag{11}$$

$$v_1^k = \frac{1}{2} - \frac{\beta_1(o_2^k - o_2^u) + s_2(o_1^k - o_1^u)}{2(s_1s_2 - \beta_1\beta_2)} - \frac{\beta_1 + s_2}{2(s_1s_2 - \beta_1\beta_2)}L \tag{12}$$

$$v_2^u = \frac{1}{2} - \frac{\beta_2(o_1^k - o_1^u) + s_1(o_2^k - o_2^u)}{2(s_1s_2 - \beta_1\beta_2)} + \frac{\beta_2 + s_1}{2(s_1s_2 - \beta_1\beta_2)}L \tag{13}$$

$$v_2^k = \frac{1}{2} - \frac{\beta_2(o_1^k - o_1^u) + s_1(o_2^k - o_2^u)}{2(s_1s_2 - \beta_1\beta_2)} - \frac{\beta_2 + s_1}{2(s_1s_2 - \beta_1\beta_2)}L \tag{14}$$

2.3 The profit and equilibrium price of mobile payment platforms

In the context of financial management for SMEs, the profit function of a mobile payment platform can be constructed by analyzing its pricing strategy and cost structure for providing services to SMEs. It is assumed that mobile payment platforms charge service fees to SMEs, with the marginal costs of these services including the costs of providing payment solutions to SMEs. The profit function of a mobile payment platform was thus defined as total revenue minus total costs. For the revenue portion, mobile payment platforms typically charge a percentage of transaction fees to SMEs, which can be adjusted based on the volume of transactions, the choice of payment methods, and other value-added services. Platforms may also charge monthly or annual fixed service fees to cover the costs of infrastructure maintenance and ongoing technical support. Assuming the marginal costs of providing services to users on both sides of the mobile payment clearing platform are denoted by z_1^u and z_2^u , and the traditional payment clearing platform by z_1^k and z_2^k , this study assumes the marginal costs for both platforms are identical, i.e., $z_1^u = z_1^k = z_1$ and $z_2^u = z_2^k = z_2$. Therefore, the profit functions are as follows:

$$Q^u = (o_1^u - z_1^u)v_1^u + (o_2^u - z_2^u)v_2^u \tag{15}$$

$$Q^k = (o_1^k - z_1^k)v_1^k + (o_2^k - z_2^k)v_2^k \tag{16}$$

By solving the above equations simultaneously, the following equation can be obtained:

$$Q^{u,k} = (o_1^k - z_1) \left(\frac{1}{2} - \frac{\beta_1(o_2^k - o_2^u) + s_1(o_1^k - o_1^u)}{2(s_1s_2 - \beta_1\beta_2)} - \frac{\beta_1 + s_2}{2(s_1s_2 - \beta_1\beta_2)} L \right) + (o_2^k - z_2) \left(\frac{1}{2} - \frac{\beta_2(o_1^k - o_1^u) + s_1(o_2^k - o_2^u)}{2(s_1s_2 - \beta_1\beta_2)} - \frac{\beta_2 + s_1}{2(s_1s_2 - \beta_1\beta_2)} L \right) \quad (17)$$

In this model, the first-order condition for profit maximization of the mobile payment platform was obtained by setting the first derivative of the price to zero, i.e., $\partial\Pi^k/\partial o_1^k = 0$ and $\partial\Pi^k/\partial o_2^k = 0$. To simplify the calculations, it is assumed that $o_1^u = o_1^k = o_1$, $o_2^u = o_2^k = o_2$, and $s_1 = s_2 = s$. Therefore, the following can be derived:

$$o_1 = s_1 + z_1 - \frac{\beta_2}{s_2}(\beta_1 + o_2 - z_2) - \frac{\beta_1 + s_2}{s_2} L \quad (18)$$

$$o_2 = s_2 + z_2 - \frac{\beta_1}{s_1}(\beta_2 + o_1 - z_1) - \frac{\beta_2 + s_1}{s_1} L \quad (19)$$

In the context of financial management for SMEs, the equilibrium price function for mobile payment platform providers needs to account for transfer costs between platforms and cross-network externalities. When SMEs choose a payment platform, they must consider the costs of switching from one platform to another, which include learning the new platform's operation, reconfiguring systems, and retraining employees. The cross-network externalities β_1 and β_2 between users on both sides play a crucial role in determining the equilibrium price. For SMEs, the value of a payment platform increases as more SMEs use it, which influences their choice. Conversely, as more SMEs use a particular payment platform, it attracts even more SMEs to join. By solving the above equations, the following can be derived:

$$o_1 = s + z_1 - \beta_2 + \frac{(\beta_2)^2 + \beta_2s + (\beta_1 + s)s}{(s)^2 - \beta_1\beta_2} L \quad (20)$$

$$o_2 = s + z_2 - \beta_1 + \frac{(\beta_1)^2 + \beta_1s + (\beta_1 + s)s}{(s)^2 - \beta_1\beta_2} M \quad (21)$$

For convenience in calculations, let $V = 1/(s)^2 - \beta_1\beta_2L$, where it is known that $\partial V/\partial L > 0$. By substituting this into the above equations, the following can be obtained:

$$o_1 = s + z_1 - \beta_2 + ((\beta_2)^2 + \beta_2s + (\beta_1 + s)s)V \quad (22)$$

$$o_2 = s + z_2 - \beta_1 + ((\beta_1)^2 + \beta_1s + (\beta_2 + s)s)V \quad (23)$$

By combining the equilibrium price of mobile payment platforms with the user quantity expressions, the following can be derived:

$$v_1^u = \frac{1}{2}(1 + (\beta_1 + s)V) \quad (24)$$

$$v_1^k = \frac{1}{2}(1 - (\beta_1 + s)V) \quad (25)$$

$$v_2^u = \frac{1}{2}(1 + (\beta_2 + s)V) \tag{26}$$

$$v_2^k = \frac{1}{2}(1 - (\beta_2 + s)V) \tag{27}$$

2.4 Total profit, surplus, and social welfare of mobile payment platforms

The total profit of mobile payment platforms is derived from the total revenue obtained from SMEs and their customers at equilibrium prices, minus the operating costs. Equilibrium prices ensure that the platform can attract a sufficient number of SMEs and their customers, thereby maximizing its profit.

$$Q = Q^u + Q^k = 2s + 2(s)^2V - \beta_1 - \beta_2 - (\beta_1)^2V - (\beta_2)^2V \tag{28}$$

Through calculation, it is known that $\partial Q/\partial L = \partial Q/\partial V \partial V/\partial L > 0$, indicating that mobile payment methods increase the utility of SMEs and merchants. The surplus for SMEs is the utility obtained by SMEs after paying the price, which exceeds the amount they pay. It represents the net benefit that SMEs gain from using the platform. By providing more efficient and convenient services, mobile payment platforms can increase the surplus of small and medium-sized enterprises.

$$\begin{aligned} ZT &= \int_0^{v_1^u} (\beta_1 v_2^u - o_1^u - s_1 a_1) f a_1 + \int_{v_1^u}^1 (\beta_1 v_2^k - o_1^k - s_1(1 - a_1)) f a_1 \\ &+ \int_0^{v_2^u} (\beta_2 v_1^u - o_2^u - s_2 a_2) f a_2 + \int_{v_2^u}^1 (\beta_2 v_1^k - o_2^k - s_2(1 - a_2)) f a_2 \\ &= \frac{3}{2}(\beta_1 + \beta_2) - (z_1 + z_2) - \frac{5}{2}s + (\beta_1 \wedge 2 + \beta_2 \wedge 2 - 2s \wedge 2)V \\ &+ \frac{1}{4}(2(\beta_1)^2 + 2(\beta_2)^2 + s(\beta_1)^2 + s(\beta_2)^2 + 4s\beta_1\beta_2 - 3(s)^3)V \wedge 2 \end{aligned} \tag{29}$$

Total social welfare is the sum of the surplus of SMEs and the profit of the platform, representing the net utility gained by society from platform transactions. An efficient mobile payment platform, by reducing transaction costs and improving service quality, can increase total social welfare.

$$\begin{aligned} T &= Q + ZT \\ &= \frac{1}{2}(\beta_1 + \beta_2 - s) - (z_1 - z_2) \\ &+ \frac{1}{4}(2(\beta_1)^2 \beta_2 + 2\beta_1(\beta_2)^2 + s(\beta_1)^2 + s(\beta_2)^2 + 4s\beta_1\beta_2 - 2(s)^3)(V)^2 \end{aligned} \tag{30}$$

Through calculation, it is known that $\partial T/\partial L = \partial T/\partial V \partial V/\partial L > 0$. Therefore, the emergence of mobile payment platforms reduces transaction costs, increases competition in the payment services market, enhances the utility of SMEs and their customers, boosts the profits of mobile payment platform enterprises, and increases total social welfare, thereby improving the financial management efficiency of small and medium-sized enterprises.

Figure 3 illustrates the theoretical concept diagram of how mobile payments enhance the financial management efficiency of SMEs. Through the above model analysis, the conclusions were drawn.

The influence of emerging mobile payment methods has significantly reduced the transfer costs between platforms, leading to increased market competition.

For SMEs, this competitive environment enhances their bargaining power and reduces concerns when choosing payment platforms, ultimately lowering transaction costs. This is particularly crucial as SMEs typically have limited resources, and reduced transaction costs directly impact their financial management efficiency.

- **Increased user utility:** Mobile payments provide more convenient and efficient payment solutions, significantly improving the user experience for both consumers and merchants. For SMEs, consumers using convenient mobile payment methods can expedite the transaction process and increase cash flow turnover. This utility enhancement is evident on both the consumer and merchant sides, increasing the number of potential customers and transaction volumes for merchants using the platform.
- **Expanded market size:** As mobile payments lower transfer costs between platforms, more SMEs and consumers opt to use mobile payment platforms. This expansion in user scale creates a positive feedback loop for platform enterprises, further enhancing the platform’s network effects and increasing profits.
- **Enhanced financial management efficiency:** The widespread adoption of mobile payments provides SMEs with more transparent transaction records and faster cash flows. These characteristics directly improve financial management efficiency, enabling businesses to make more timely financial and management decisions. For instance, businesses can reconcile accounts more quickly, reducing the manual costs and risks of errors in financial management.
- **Increased social welfare:** The proliferation of mobile payments enhances overall social welfare by improving the financial management efficiency of SMEs and reducing operational costs. This allows businesses to allocate more resources to the development of core activities. This efficiency improvement benefits not only the businesses themselves but also promotes the efficiency of resource allocation across the entire market, ultimately fostering economic prosperity.

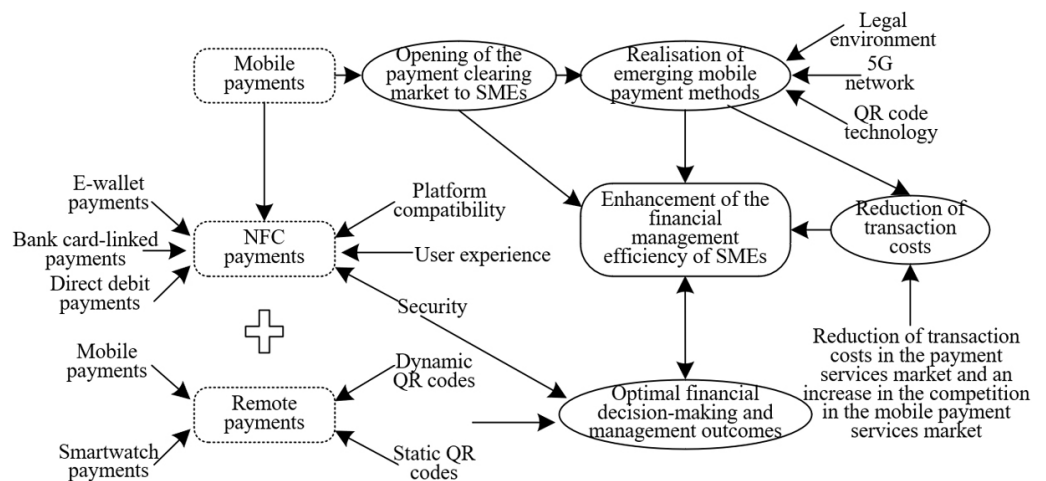


Fig. 3. The theoretical concept diagram of mobile payments enhancing the financial management efficiency of SMEs

3 EXPERIMENTAL RESULTS AND ANALYSIS

Figure 4 illustrates the scatter plot between the payment variable of mobile payments and the user scale and user utility of mobile payment platforms. It can be

qualitatively observed from the figure that there is a positive correlation between the payment variable and both the user scale and user utility of mobile payment platforms. Specifically, as the user scale of mobile payment platforms increases, the payment variable also increases, with the points in the scatter plot showing a trend towards the upper right. Similarly, an improvement in the user utility of mobile payment platforms is accompanied by an increase in the payment variable, with the scatter plot points displaying a clear positive relationship. Two main conclusions can be drawn from the scatter plot results in Figure 4. Firstly, the user scale of mobile payment platforms has a significant positive impact on the payment variable of mobile payments. This indicates that as the user scale expands, the payment activities on the platform also increase, reflecting the promoting effect of user numbers on platform payment behavior. Secondly, the increase in user utility of mobile payment platforms is also positively correlated with the payment variable, suggesting that the enhancement of user utility on the platform further stimulates the activity of payment behavior.

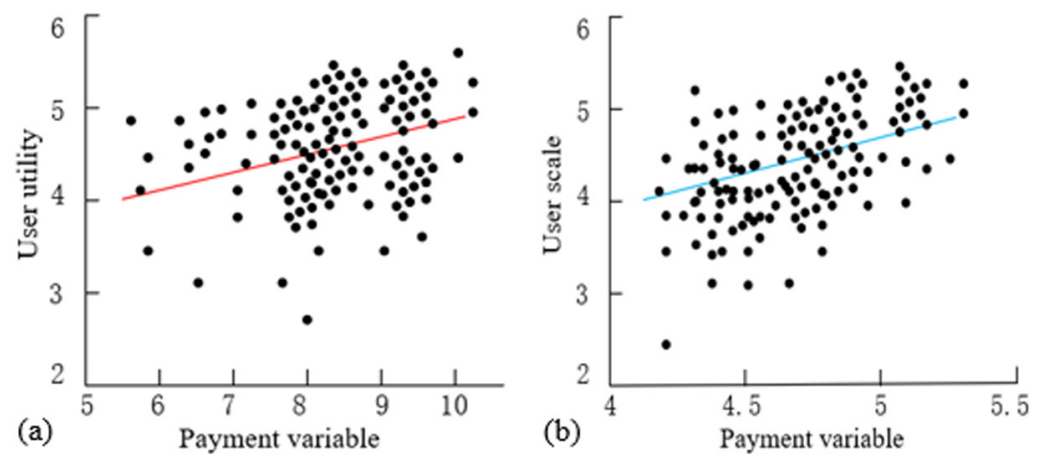


Fig. 4. Scatter plot of payment variable of mobile payments and user scale and utility

The financial management efficiency index of SMEs reflects the overall efficiency of an enterprise in the allocation, utilization, management, and supervision of financial resources through a series of quantitative indicators and qualitative assessments. This index not only considers the financial health of the enterprise but also the extent to which financial management supports the operational and strategic objectives of the enterprise. The index is typically calculated using weighted scoring systems or data envelopment analysis methods. These methods combine financial statements and market data to comprehensively analyze various financial indicators, providing a quantitative assessment of the financial management efficiency of enterprises.

Table 1 presents the regression analysis results between the financial management efficiency index of SMEs and several key variables. The four regression models progressively introduce the explanatory variables: user utility, user scale, platform profit, and equilibrium price of the mobile payment platform. The results of Model 1 indicate that user utility of the mobile payment platform has a significant positive impact on the financial management efficiency index of SMEs, with a coefficient of 4.258, a standard error of 0.265, and a significance level of 1% ($p < 0.01$). As the model expands, Model 2 introduces a user scale, showing a negative impact on the financial management efficiency index with a coefficient of -0.0524 and a standard error of 0.00785 ($p < 0.01$). Model 3 further incorporates platform profit, revealing a significant positive impact on the financial management efficiency index, with

a coefficient of 0.412 and a standard error of 0.0456 ($p < 0.01$). Model 4 adds equilibrium price on this basis, finding that equilibrium price also positively affects the financial management efficiency index, with a coefficient of 0.356 and a standard error of 0.123 ($p < 0.01$). The R-squared value increases from 0.668 in Model 1 to 0.865 in Model 4, indicating that the explanatory power of the model enhances as more variables are introduced. It can be observed from the regression results that the user utility and platform profit of the mobile payment platform positively contribute to the financial management efficiency of SMEs. This suggests that when enterprises effectively leverage mobile payment platforms to enhance user utility and profit, their financial management efficiency improves accordingly. Conversely, user scale has a negative impact on financial management efficiency, possibly due to the increased management complexity and operational costs faced by enterprises as user scale expands. The positive impact of equilibrium price implies that a reasonable pricing strategy can help enhance the financial management efficiency and competitiveness of enterprises.

Table 1. Final regression results

Variables	Financial Management Efficiency Index of SMEs			
	Model 1	Model 2	Model 3	Model 4
User utility of the mobile payment platform	4.258***(0.265)	2.512***(0.323)	1.125***(0.313)	0.686***(0.323)
User scale of the mobile payment platform		-0.0524***(0.00785)	-0.0356***(0.00635)	-0.0316***(0.00624)
Profit of the mobile payment platform			0.412***(0.0456)	0.336***(0.0524)
Equilibrium price of the mobile payment platform				0.356***(0.123)
Constant	-29.35***(2.154)	-10.25***(3.354)	-2.625(2.754)	0.305(2.854)
Observations	152	152	152	152
R-squared	0.668	0.754	0.856	0.865
Number of pro Hausman tests	32	32	32	32
	234.25***	43.25	245.36	305.58
Prob>chi2	0.0000	0.0000	0.0000	0.0000
Wald test for heteroscedasticity	1789.45***	615.26***	1389.25***	9658.25***

Notes: Values in parentheses represent standard errors; ***indicates $p < 0.01$.

Table 2. Regression results of robustness tests using management efficiency influencing factors as explanatory variables

Variables	Financial Management Efficiency Index of SMEs	
	Model 3	Model 4
Transaction costs in the payment services market	2.612***(0.368)	
Degree of competition in the mobile payment services market		8.613***(1.112)
Total profit of the mobile payment platform	-0.0105*(0.00622)	-0.00742(0.00608)
Enterprise surplus	0.164***(0.0512)	0.162***(0.0489)
Social welfare	0.289***(0.102)	0.0925(0.105)
Constant	-14.35***(3.002)	0.622(0.905)

(Continued)

Table 2. Regression results of robustness tests using management efficiency influencing factors as explanatory variables (Continued)

Variables	Financial Management Efficiency Index of SMEs	
	Model 3	Model 4
Observations	152	152
R-squared	0.912	0.908
Number of pro Hausman tests	32	32
	80.23***	87.88***
Prob>chi2	0.0000	0.0000
Wald test for heteroscedasticity	4235.12***	2968.54***

Notes: Values in parentheses represent standard errors; ***indicates $p < 0.01$.

Table 2 displays the regression results of robustness tests using management efficiency influencing factors as explanatory variables to analyze the impact on the financial management efficiency of SMEs. The results of Model 3 show that transaction costs in the payment services market have a significant positive impact on the payment index, with a coefficient of 2.612, a standard error of 0.368, and a significance level of 1% ($p < 0.01$). The impact of the total profit of the mobile payment platform on the payment index is negative, with a coefficient of -0.0105 , a standard error of 0.00622, and significant at the 10% level ($p < 0.1$). Both enterprise surplus and social welfare have positive impacts on the payment index, with coefficients of 0.164 (standard error of 0.0512, $p < 0.01$) and 0.289 (standard error of 0.102, $p < 0.01$), respectively. Model 4 further introduces the degree of competition in the mobile payment services market, showing a significant positive impact on the payment index with a coefficient of 8.613 and a standard error of 1.112 ($p < 0.01$). However, the impact of social welfare on the payment index is no longer significant in this model. The R-squared values are 0.912 and 0.908, respectively, indicating strong explanatory power of the models.

Table 3. Existence and heterogeneity analysis results

Variables	SMEs and their Customers		SMEs	SME Customers
	FE	RE	FE	FE
User utility of the mobile payment platform	$-0.0215^{***}(0.001)$	$-0.0085^{***}(0.001)$	$-0.0255^{***}(0.001)$	$-0.0256(0.001)$
User scale of the mobile payment platform	$0.0375^{***}(0)$	$0.0087^{***}(0.015)$	$0.0325^{***}(0.015)$	$0.0326^{***}(0.071)$
Profit of the mobile payment platform	$0.0456(0.195)$	$-0.0202(0.287)$	$0.0725(0.275)$	$-0.011(0.923)$
Equilibrium price of the mobile payment platform	$0.0028(0.425)$	$-0.0045(0.163)$	$0.0067(0.163)$	$0.0047(0.48)$
Transaction costs in the payment services market	$0.00002(0.78)$	$-0.00004(0.165)$	$0.0002(0.165)$	$0.00008(0.778)$
Degree of competition in the mobile payment services market	$0.1536(0.285)$	$0.0204*(0.078)$	$0.6789*(0.078)$	$0.8023^{**}(0.034)$

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 3 presents the regression results of the existence and heterogeneity analysis for SMEs and their customers. The impacts of profit and equilibrium price of the mobile payment platform were not significant, as they did not pass the significance tests. Similarly, the transaction costs in the payment services market did not show significant impacts across different types of enterprises, with the exception that

the degree of competition in the mobile payment services market had a significant positive impact on SME customers (FE: 0.8023**). The results of the existence and heterogeneity analysis reveal that the negative impact of mobile payment platform user utility suggests that as platform user utility increases, the financial management efficiency of SMEs and their customers decreases. This may be because users prefer mobile payment platforms, reducing their reliance on traditional financial management services. Conversely, the positive impact of user scale indicates that as the user base expands, SMEs can enhance their service coverage and financial management efficiency through a broader user base. Moreover, the significant positive impact of the degree of competition in the mobile payment services market on SME customers indicates that in a highly competitive market environment, SME customers can improve their financial management efficiency by optimizing services and enhancing quality.

These findings suggest that SMEs should focus on balancing user utility and scale when utilizing mobile payment platforms. Additionally, in highly competitive markets, maintaining competitiveness by improving service quality can provide valuable insights for updating the financial management model for small and medium-sized enterprises.

4 CONCLUSION

This study primarily explores the impact of mobile payments on the financial management efficiency of SMEs. The research content is divided into two parts: first, the factors influencing the financial management efficiency of SMEs were defined and analyzed to provide a reference for updating the financial management model for SMEs; second, a theoretical model was constructed and derived to explore the impact of mobile payment platforms' user utility, user scale, platform profit, and equilibrium price on the financial management efficiency of SMEs. The experimental results include the scatter plot of the payment variable and dependent variable of mobile payments, the final regression results, the regression results of robustness tests using management efficiency influencing factors as explanatory variables, and the existence and heterogeneity analysis results. A qualitative observation from the scatter plot reveals a positive correlation between the payment variable and both user scale and user utility of mobile payment platforms. This indicates that increases in user scale and user utility drive an increase in payment activities. The final regression results show the significant impact of user utility and user scale of mobile payment platforms on financial management efficiency. The robustness test results validate these impacts, while the existence and heterogeneity analysis further reveal the differences faced by various types of enterprises.

Through a comprehensive analysis of the experimental results, the following conclusions were drawn: The user scale and user utility of mobile payment platforms have a significant positive impact on the financial management efficiency of SMEs. This suggests that as the user base expands and the user experience improves, SMEs can enhance their financial management efficiency, thereby increasing their competitiveness in the market. The value of this study lies in revealing the potential of mobile payment platforms in promoting financial management efficiency and enhancing the market competitiveness of enterprises, providing valuable references for business managers and policymakers. Future research could focus on: a) further examining how different mobile payment platforms uniquely affect enterprise financial management efficiency; b) using qualitative research methods to deeply

analyze their real-world applications and impacts in specific businesses; and c) evaluating the effects of macroeconomic conditions and policy changes on mobile payment platforms and enterprise financial management. These efforts could enhance our understanding and optimization of mobile payment platforms in business management.

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