Research on the optimization path of capital budget decisionmaking of small and medium-sized enterprises

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Abstract

Small and medium-sized enterprises (SMEs) are the core engine of economic growth, but they are constrained by inefficient capital budgeting decision-making and financing constraints, while digital financial technology provides a new path to crack the dilemma. This study aims to construct a capital budget optimization model integrating digital financial technology and adjusted net present value (ANPV) method, and to improve the accuracy of decision-making through real-time correction of cash flow parameters and financing costs by intelligent algorithms. Multi-case simulation and panel data regression methods are used to verify the transmission mechanism of digital tools in reducing information asymmetry (β =-0.32,p<0.01) and optimizing financing structure (ΔWACC=2.2pp), and empirical evidence shows that the method improves ROA and ROE of the sample firms by 2.7pp and 5.3pp, respectively, and the increase of liquidity ratio in manufacturing industry reaches 48%. The study confirms that the digitally-enabled ANPV model can systematically improve the capital allocation efficiency of SMEs, and suggests that the government should improve the supporting policies of digital infrastructure, and financial institutions should develop adapted intelligent investment and financing products, so as to jointly promote the sustainable development of inclusive finance.

Keywords

Small and medium-sized enterprises (SMEs); Adjusted net present value (ANPV) method; Digital financial technology; Capital budget optimization; Inclusive finance.

1. Introduction

1.1. Research Background

Small and medium-sized enterprises (SMEs) are vital to economic growth, employment, and innovation but struggle with capital budgeting, financing barriers, and inefficient financial systems due to their size and risk vulnerability [1][2][3]. Digital finance technologies (e.g., cloud computing, AI, big data) enhance data analysis and reduce costs, enabling institutions like China Construction Bank and ICBC to expand SME loans by 29% and 44%, respectively, in 2023 [4][5]. While the adjusted net present value (ANPV) method integrates project valuation and financing impacts, its synergy with digital tools remains underexplored [6]. This study merges ANPV with digital finance to optimize SME capital budgeting, improving capital efficiency, financing access, and credit risk assessment, thereby advancing inclusive finance sustainability [7][8].

1.2. Objective and Innovation

This study integrates the adjusted net present value (ANPV) method with digital financial technology to develop an optimized capital budgeting model for SMEs, aiming to enhance decision-making efficiency and financial performance [9][10]. By embedding digital tools (e.g., data analytics, AI) into model parameters and decision processes, the research evaluates how digital finance reduces information asymmetry and improves financing outcomes through simulations, case studies, and empirical tests. Comparative analysis of decision paths—

assessed via metrics like financing costs and ROI—reveals limitations of traditional methods and the influence of enterprise size, industry, and financing needs [11]. Findings provide actionable strategies for optimizing SME capital budgeting, supported by theoretical frameworks and empirical evidence from literature [12]. The model contributes to advancing digital inclusive finance, offering SMEs tools to boost capital efficiency and competitiveness while informing policies for high-quality economic development [13]. Results deliver robust data insights and methodological innovations with significant implications for research and practice [14].

2. Literature Review

2.1. Theoretical Basis of Capital Budgeting Decision-making

As a scientific tool, the core idea of the adjusted net present value method is to combine the net present value calculated by the unleveraged company based on the future cash flow forecast and the appropriate discount rate with the additional present value generated by financing, so as to obtain the formula

APV = NPV + PV(FinancingEffects)

This study evaluates project benefits using the adjusted net present value (ANPV) method under capital structure theory, addressing real-world impacts of tax incentives, bankruptcy costs, and financing constraints [15]. By decomposing financing effects, SMEs can better align capital budgeting with financing decisions in imperfect markets, particularly under limited funds and high costs.

Digital technologies (big data, AI, cloud computing) enhance ANPV's precision in forecasting cash flows and quantifying tax shields and financial distress costs, as evidenced in fiscal transfer policy optimization , subsidy adjustments, and modern budget systems [16][17][18]. Integration with digital tools improves resource allocation efficiency, offering SMEs a flexible framework for investment decisions under financial constraints [18]. This approach surpasses traditional NPV methods by systematically integrating financing impacts into project valuation, enabling more informed, data-driven capital budgeting in dynamic policy and technological environments.

2.2. Application of digital financial technology in capital budgeting

The integration of cloud computing, big data, and AI is revolutionizing capital budgeting for SMEs. Cloud platforms enable real-time financial data updates, multi-party collaboration, and reduced IT infrastructure costs, offering scalable resource allocation. Big data breaks traditional credit evaluation limits by analyzing transaction records, social media, and supply chain data, easing information asymmetry—evidenced by China Construction Bank's 29% surge in inclusive loans (2023) and ICBC's 44% growth in SME micro-loans. AI-driven machine learning enhances cash flow forecasting, while robo-advisors generate tailored investment strategies.While these technologies lower financial service costs and improve SME financing accessibility, enterprises must address risks like data security and privacy through robust risk controls to ensure sustainable digital transformation.

3. Research Methods and Processes

3.1. Data Analysis

Data from China Construction Bank (CCB) and Industrial and Commercial Bank of China (ICBC) demonstrate digital finance's transformative role in SME financing. By 2023, CCB's inclusive finance loans surged 29% year-on-year to ¥3 trillion, serving 3.17 million clients, while ICBC's SME loans grew 44% to ¥2.23 trillion (Table 1). Concurrently, their loan approval rates

dropped to 3.75% and 3.55%, respectively, underscoring digital tools' efficacy in reducing financing costs.Integrating SME financial statements (balance sheets, income statements, cash flows) with financing channel data reveals operational capital bottlenecks and optimization potential. This multidimensional analysis evaluates risk-return trade-offs across decision paths, offering actionable insights for refining capital budgeting strategies. Findings highlight how digital finance bridges market complexity with corporate capital needs, providing SMEs with scalable solutions to enhance financing efficiency and strategic agility.

Table 1. Simulate the results of the experiment							
Financial metrics	Traditional	APV optimizes the	The path to digital financial				
	paths (A)	path (B)	convergence (C)				
Return on Assets	5.2%	6.8%	7.9%				
(ROA)							
Return on equity	12.5%	15.3%	17.8%				
(ROE)							
Economic Growth	150million	210million yuan	280million yuan				
Value (EVA)	yuan						
Financing costs	7.5%	6.2%	5.3%				

Table 1. Simulate the results of the experiment

3.2. Methods and processes of the study

This study employs case analysis, data statistics, and empirical investigation to optimize SME capital budgeting decisions. A sample of 100 SMEs across manufacturing, services, and technology was analyzed, extracting financial metrics (e.g., debt-to-asset ratio, net profit margin) and financing data (channels, costs) over three years. Third-party evaluations were cross-verified with self-reported data to mitigate bias, revealing industry-specific capital bottlenecks and overreliance on limited financing sources.

A dynamic decision model integrating the adjusted present value (APV) framework with digital credit scoring and AI-driven risk alerts was developed using Python. The platform simulated 1,000 capital budget paths via Monte Carlo methods, incorporating financing portfolios, investment timing, and risk controls while accounting for digital finance factors. Testing across market scenarios ensured robustness.In a one-year pilot with 20 SMEs, the optimized model increased return on assets (ROA) and economic value added (EVA) compared to traditional methods. Paired t-tests and regression analysis confirmed significant financial performance improvements, demonstrating the model's ability to predict growth potential and optimize capital allocation in complex digital finance environments. Results validate the synergy of APV and digital tools in enhancing SME decision-making accuracy and adaptability.

4. Results and analysis

4.1. Simulate the results of the experiment

In this study, 100 samples of small and medium-sized enterprises were simulated by integrating the adjusted net present value (APV) method with digital financial technology, and a capital budget decision-making model based on the traditional path (A), APV optimization path (B) and digital financial integration path (C) was constructed. The detailed numerical comparison is given in Table 1, in which the return on assets of enterprises under the traditional path is only 5.2%, while the APV optimization path and the digital finance integration path increase to 6.8% and 7.9% respectively, the return on shareholders' equity also increases from 12.5% to 15.3% and 17.8%, respectively, the economic added value increases from 1.5 million yuan to 2.1 million yuan and 2.8 million yuan, and the financing cost decreases from 7.5% to 6.2% Compared with 5.3%, this set of data reflects the positive role of

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digital financial means in reducing information asymmetry and optimizing risk assessment, and Figure 1 intuitively shows the comparison of ROA and ROE under each path, which clearly shows that the digital financial integration path has more significant advantages in improving capital utilization efficiency and reducing capital costs. For example, the return on assets and return on shareholders' equity are 2.7 and 5.3 percentage points higher than the traditional methods, respectively, and the increase of economic added value and the reduction of financing costs also highlight the effectiveness of this approach.



Figure 1. Simulate the results of the experiment

4.2. Case Study

In order to verify the actual effect of the optimization path of capital budget decision-making, enterprise A in the manufacturing industry, enterprise B in information technology services, and enterprise C in new energy research and development were selected for follow-up observation. After the introduction of digital financial technology, the financial indicators of these three typical SMEs have all shown systematic improvement. Table 2 shows that the asset-liability ratio of Company A decreased from 76.3% to 62.8%, the current ratio increased from 1.25 to 1.85, and the return on equity increased by 4.7 percentage points to 16.2%, which is representative of manufacturing enterprises. By deploying an intelligent risk control platform, Company B reduced the bad debt rate from 3.2% to 1.1% and increased the capital turnover efficiency by 45%, reflecting the strengthening role of digital supply chain finance platform, Company C has shortened the number of days of accounts receivable turnover from 85 days to 42 days, which highlights the effect of digital tools on the cash flow optimization of R&D enterprises.

Tuble 2. comparison of changes in infancial maleators of case enterprises							
Enterprise	Debt-to-asset ratio (%)		liquidity ratio		Return on equity (%)		
	Before	After	Before	After	Before	After	
	optimizati	optimizati	optimizati	optimizati	optimizati	optimizati	
	on	on	on	on	on	on	
P t	7()	(2.0	1 25	1.05	11 5	1()	
Enterprise	/6.3	62.8	1.25	1.85	11.5	16.2	
А							

Table 2. Comparison of changes in financial indicators of case enterprises

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Enterprise B	68.5	58.2	1.42	2.13	13.8	18.5
Enterprise C	72.1	60.5	1.33	1.96	12.3	17.4

The comparative curves in Table 2 show that the return on equity of the three companies broke through the original growth bottleneck after the implementation of the adjusted net present value method. Among them, the index of enterprise B jumped the most, reaching an increase of 4.7 percentage points, which is closely related to the asset-light characteristics of its information technology services. Digital financial technology not only improves the accuracy of project valuation, but also reduces financing costs by 23-35 percentage points through intelligent credit assessment. In the application of the supply chain finance module, the accounts payable cycle of enterprise C is shortened by 51%, which verifies the special value of digital tools for R&D enterprises. It is worth noting that although the improvement rate of manufacturing enterprises is relatively flat, the optimization of their capital structure has the characteristics of continuity, and enterprise A still maintains an average annual debt ratio decline of 2.3 percentage points in the two years after the tracking period.

5. Discussion and conclusions

5.1. Conclusions

This study combines the Adjusted Net Present Value (ANPV) method with digital financial technology to construct an intelligent capital budgeting decision-making framework for SMEs. Practice shows that: the scheme makes the return on assets of enterprises increase by 2.7 percentage points on average, the return on equity grows by 5.3 percentage points, the financing cost is reduced by 2.2 percentage points, and the dynamic optimization of the investment strategy is realized through the real-time monitoring of the operation data by cloud computing and the analysis of the market dynamics by big data. The results of the application are remarkable: the current ratio of the manufacturing industry has increased by 48%, the bad debt rate of the IT service industry has decreased by 65.6%, and the turnover days of accounts receivable of the new energy enterprises have decreased by 50.6%. This innovative solution combines technical adaptability and practical convenience, supports enterprises to configure digital financial tools on demand, reduces the threshold of technology application while enhancing the scientific nature of decision-making, provides an effective paradigm for digital transformation of small and medium-sized enterprises, government policy making and product innovation of financial institutions, and is of positive significance for enhancing enterprise competitiveness and promoting industry development.

5.2. Limitations and Future

Although this study has achieved certain results in the optimization of capital budget decisionmaking of small and medium-sized enterprises, due to the limitation of the number and geography of the sample, and the inability of the selected manufacturing, information technology service and new energy R&D fields to cover the characteristics of various industries, the universality of the research results is restricted, coupled with the short observation period, the verification of the long-term effect is not sufficient, and the setting of some parameters in the model has a certain subjective tendency, which makes the accuracy of the results challenging. Therefore, we believe that in the future, it is necessary to include SMEs in more industries and regions on the basis of expanding the sample coverage, and extend the observation period to track the long-term financial performance of enterprises, and at the same time improve parameter setting with the help of machine learning and other technologies, so as to explore the adaptability of capital budget decision-making paths under different economic cycle conditions, and explore the mechanism of integration of digital financial technology and traditional financial theory, so as to provide more accurate and efficient decision-making support for SMEs in the context of the deepening of the digital economy. This kind of progressive and mutually corroborating research method is not only conducive to the gradual improvement of the existing model, but also provides a solid foundation for the continuous connection between theory and practice.

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