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Supply chain finance and financing constraints for small and medium-sized enterprises: a structured review and research agenda

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Abstract. Financing constraints severely plague Small and Medium-sized Enterprises (SMEs) in emerging markets, rooted in information asymmetry and insufficient collateral. Traditional trade credit fails to relieve suppliers' receivables pressure, spurring innovative supply chain finance models including factoring, reverse factoring and BIF, which rely on anchor firms' credit and transaction data to ease SMEs' financing difficulties. This paper adopts a literature review and comparative approach. It builds a framework covering theoretical foundations, model evolution, digital empowerment and research prospects, and compares mainstream models from credit evaluation, bargaining power, payment rules, information governance and risk allocation. Results show supply chain finance mitigates information asymmetry but has boundaries; its effects depend on contract design. Block chain reduces operational frictions yet cannot remove fundamental commercial risks. This comparative framework clarifies academic consensus and debates, and puts forward testable research questions to guide future empirical work.

Keywords: supply chain finance, small and medium-sized enterprises, financing constraints, commercial credit, block chain

1. Introduction

Small and Medium-sized Enterprises (SMEs) are a vital source of employment and market vitality. However, they have long faced external financing constraints. Traditional bank credit approvals primarily rely on hard data, including standardized financial statements and real estate collateral. Many SMEs have inadequate financial systems and limited assets available for collateral. This significantly increases banks' costs for information screening and risk control. As a result, credit rationing is widespread. A systematic review by Gelsomino et al. [1] indicates that academic research on supply chain finance falls into two distinct perspectives. One is finance-oriented, and the other is supply chain-oriented. The finance-oriented perspective views supply chain finance as short-term financial solutions provided by financial institutions, focusing on accounts payable and accounts receivable. The supply chain-oriented perspective has a broader scope, incorporating inventory-based collaborative financing and even fixed-asset-based collaborative financing into

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its analysis. Conceptual differences between these two perspectives have also led to fragmentation in research frameworks.

Commercial credit, as a financing arrangement that emerges spontaneously within supply chains, has long been the subject of academic attention; however, the flow of funds under this mechanism is unidirectional. It mostly manifests as upstream suppliers providing credit sales to downstream buyers. While this alleviates the cash flow pressure on downstream enterprises, it shifts liquidity pressure upstream. Small and medium-sized suppliers, in turn, end up with substantial accounts receivable due to these credit sales. This structural flaw in commercial credit precisely explains the rise of accounts receivable-based supply chain finance. The introduction of each new model typically involves contractual optimization aimed at addressing the practical contradictions exposed by the previous generation of business practices. Based on multiple case studies in Europe, Wuttke et al. [2] point out that supply chain finance constitutes an upstream-oriented, process-driven innovation. Innovation is initiated by large buyers but requires acceptance by the supplier community. Suppliers' willingness to adopt such models is a key determinant of a project's success or failure. The value of a model cannot be assessed solely from the perspective of the buyer's unilateral benefits. With the development of the digital economy, technological concepts such as blockchain have gradually entered the practice of supply chain finance, where they are viewed as potential tools for resolving frictions in traditional business processes.

Existing research has analyzed supply chain finance from the perspectives of theoretical modeling, case studies, and micro-level empirical analysis. However, most studies focus on testing the effectiveness of a single model and lack a multidimensional framework for cross-comparison. There are also significant divergences within the existing literature. Is reverse factoring a tool for financial inclusion of Small and Medium-sized Enterprises (SMEs), or a means for dominant buyers to extend payment terms? Does supply chain finance reduce overall supply chain risk, or does it merely transfer and concentrate risk to core enterprises? No consensus has yet been reached on these issues. Wuttke et al. [3], drawing on empirical analysis of a large-scale platform dataset comprising over 1,400 buyer-supplier pairs, further revealed that, in addition to economic efficiency motives, institutional legitimacy motives significantly influence the speed at which suppliers adopt supply chain finance. These motives include pressure to conform, normative pressure, and coercive pressure. This implies that explaining adoption behavior solely through financial returns is insufficient; organizational and institutional factors are equally important. At the same time, existing discussions on blockchain tend to focus on potential benefits. There is a lack of systematic analysis of practical constraints such as the authenticity of off-chain data, legal enforce ability, and implementation costs. Compared to well-established practices like factoring and reverse factoring, the volume of literature on BIF is significantly smaller. It is necessary to clearly define and clarify its theoretical positioning and objectively assess the rationale for its status as a mainstream model.

This paper avoids a summary-style listing of the literature. The study integrates the literature classification framework from systematic reviews by Gelsomino et al. [1], the innovation adoption theory based on multiple case studies by Wuttke et al. [2], and the evidence on adoption drivers from large-sample empirical studies by Wuttke et al. [3] This review will proceed along the following lines: theoretical origins, multidimensional model comparison and analysis, examination of the logic of digital empowerment, research consensus, and specific, testable questions for future research.

2. Theoretical origins: the internal logic and structural limitations of commercial credit

The theoretical foundation of supply chain finance is built upon research into the drivers of commercial credit. The academic community has generally developed multiple competing explanatory frameworks regarding the drivers behind the formation of commercial credit. Research on the mechanisms underlying the formation of credit between enterprises has fostered a complementary and critical dialogue. Gelsomino et al. [1] point out that there is significant overlap between the literature on commercial credit and research on supply chain finance. The motivations behind commercial credit and decisions regarding credit terms serve as important theoretical sources for supply chain finance. However, commercial credit focuses primarily on bilateral transactions and lacks discussion of supply chain finance scenarios involving the intervention of third-party financial institutions.

Early monitoring advantage theories emphasized that suppliers can obtain information on a buyer's operational status at low cost through ongoing business transactions. Compared to banks, suppliers possess a natural comparative advantage in information monitoring. Consequently, suppliers are willing to extend commercial credit to credit-constrained buyers. Burkart and Ellingsen's [4] theory of physical financing revised this perspective. Rather than focusing solely on information asymmetry, they pointed out that the unique advantage of supplier credit does not stem entirely from the ability to obtain information. Instead, this advantage arises from the fundamental difference in the difficulty of misappropriating inputs versus cash. Physical production materials are difficult for borrowers to divert for personal gain, whereas cash is highly susceptible to misappropriation and misuse. This constitutes the core characteristic that distinguishes commercial credit from bank cash loans. Model simulations further indicate that commercial credit and bank credit are not in a simple substitution relationship. When a firm's overall debt capacity is constrained, the two can complement each other. This explains a common phenomenon: suppliers tend to extend more credit on open account terms rather than provide direct loans. However, this analytical framework focuses on downstream firms facing financing constraints; while it addresses how buyers obtain commercial credit, it does not discuss the funding gaps faced by upstream small and medium-sized suppliers themselves. It fails to explain the liquidity challenges caused by tied-up accounts receivable.

Commercial credit is not driven solely by financing motives. Klapper et al. [5] conducted an empirical study using a large sample of matched buyer-seller commercial credit contracts. The study confirmed that market power, product quality guarantees, and transaction risk management all significantly influence contract terms such as payment terms and early payment discounts. Large buyers with stronger market positions are often able to secure longer payment terms. Some small and medium-sized suppliers, constrained by their weak bargaining power, are forced to extend commercial credit passively. This, in turn, exacerbates their own capital tied-up. A notable contribution of this literature is that it overcomes the limitations of previous single-firm cross-sectional data by conducting empirical tests using bilateral matched contracts. However, the sample consists primarily of large multinational enterprises as buyers. Observations of small and medium-sized enterprises acting as buyers are limited, which constrains the generalizability of the conclusions.

From this perspective, the shortcomings of commercial credit are structural. While it improves the financial conditions of downstream buyers, it transmits liquidity pressures to the upstream of the supply chain. When SMEs act as suppliers, the accounts receivable generated by credit sales become a liquidity burden. Against this backdrop, the focus of academic research and business practice has gradually shifted toward supply chain finance centered on the transfer of accounts receivable. Research has sought to utilize financial contractual instruments to unlock the value of accounts receivable assets held by upstream SMEs. According to the

classification in the literature by Gelsomino et al. [1], this category falls under finance-oriented, buyer-driven supply chain finance solutions. This is also the area where existing empirical research is most concentrated.

3. Mainstream supply chain finance models: comparative analysis under a unified framework, inherent challenges, and pathways for improvement

This section constructs a unified analytical framework. The study conducts a horizontal comparison of traditional factoring, reverse factoring, and Buyer-Intermediated Supplier Financing (BIF) across five dimensions: credit assessment logic, bargaining power, payment terms, information governance, and risk allocation. This paper clarifies the operational mechanisms and practical challenges of each model while analyzing academic disagreements found in the literature. This section introduces the innovative adoption perspective from Wuttke's series of studies. The effectiveness of these models depends not only on the financial contracts themselves but also on organizational factors such as suppliers' willingness to adopt them, as well as pressures to imitate and conform.

As shown in Table 1, this paper compares the three representative SCF models from five dimensions, Multidimensional Comparison of Mainstream Accounts Receivable-Based Supply Chain Finance Models (Dimensions of Comparison: credit assessment logic; bargaining power; payment terms; information governance; risk allocation).

Table 1. Comparison of three supply-chain-finance models

Dimension	Conventional Factoring	Reverse Factoring	Buyer-Intermediated Supplier Financing (BIF)
Credit Assessment Logic	Based on the supplier's own creditworthiness and the quality of accounts receivable.	Focuses on the creditworthiness of the core buyer and relies on the buyer's confirmation of accounts receivable; the supplier's creditworthiness carries little weight.	The core buyer sets the financing interest rate and assesses the risk of product defects; the arrangement also relies on the buyer's credit guarantee.
Bargaining Power	The supplier holds the initiative in financing; the supplier's bargaining power determines the financing rate.	The core buyer holds the initiative; the buyer's market power can be used to drive adjustments to payment terms; suppliers may adopt the arrangement due to peer pressure or regulatory compliance [3].	The buyer is deeply involved in contract design, but the original payment terms remain unchanged; this partially mitigates the buyer's ability to use SCF to squeeze suppliers, though systemic pressure still persists.
Payment Terms	The original payment terms of the underlying transaction generally remain unchanged; the supplier receives cash by assigning the accounts receivable.	In practice, this is often accompanied by an extension of accounts payable terms; changes in payment terms directly alter the supplier's actual financing burden [2, 6].	The original payment terms remain unchanged, institutionally preventing suppliers from suffering losses due to extended payment terms.

Table 1. Continued

Information Governance	The supplier submits documentation for the accounts receivable; the information originates from the supplier.	Relies on authorization data from the core buyer's internal ERP system, resulting in highly centralized information; lacks independent evidence retention by multiple parties.	Transaction information remains highly dependent on the core buyer; since guarantee liability is tied to the buyer, there is a risk of evidence tampering due to centralization, and blockchain could serve as a potential solution to address this.
Risk Allocation	In the recourse model, the risk of default is primarily borne by the supplier; in the non-recourse model, the factoring institution bears the risk of buyer default.	Financial institutions bear the risk of the core buyer's default; suppliers do not bear the risk of buyer default; however, extended payment terms amplify suppliers' operational risks.	The core buyer assumes guarantee liability and bears the payment risk arising from product defects; the supplier bears the risk of its own business failure; risks are concentrated in the core enterprise.

3.1. Conventional factoring

Standard factoring is initiated by the supplier. An upstream supplier assigns its accounts receivable from a downstream buyer to a factoring institution at a discount. The factor pays the supplier cash after deducting interest and fees. Upon maturity, the factor collects the outstanding amount from the buyer. Ordinary factoring is divided into two categories: recourse and non-recourse. Risk assessment is anchored to the supplier's own creditworthiness and operational status. Accounts receivable serve primarily as transaction documentation. A literature review by Gelsomino et al. [1] indicates that factoring was the earliest tool discussed academically in the field of supply chain finance. Early research consisted largely of surveys and industry descriptions. These studies analyzed the practical barriers to factoring adoption by enterprises in emerging markets.

This model has three distinct pain points. First, it has not moved beyond the traditional credit system's reliance on the creditworthiness of Small and Medium-sized Enterprises (SMEs). Due to insufficient information transparency among SMEs, the cost of factoring financing remains high. Second, in emerging markets with weak credit reporting systems and judicial debt verification processes, the risks of fraudulent accounts receivable and duplicate assignment of receivables are prominent. Third, under a recourse factoring structure, the risk of bad debt essentially still falls on the supplier, thereby diminishing the effectiveness of the relief measures.

Klapper [7] systematically analyzed global factoring practices. The study highlighted the limitations of traditional factoring in emerging markets. This literature is primarily based on macro-level, cross-national industry data. Its limitation lies in the lack of micro-level empirical evidence at the firm level. There is limited discussion regarding contract heterogeneity and the effects of supplier differentiation. Consequently, the focus shifted toward refining the model. The study shifted the responsibility for risk assessment to high-credit-quality core buyers, giving rise to reverse factoring.

3.2. Reverse factoring

Reverse factoring shifts the focus of risk assessment to the high-credit-quality core buyer. After the supplier completes delivery, the core buyer acknowledges the accounts payable. The financial institution extends credit

to the supplier based on the buyer's creditworthiness. Upon maturity, the core buyer repays the debt to the financial institution. Theoretically, this is expected to allow SMEs with weaker credit profiles to access financing at costs comparable to those of core enterprises.

However, during its practical implementation, this model has given rise to one of the most significant academic controversies in the field. Does reverse factoring truly benefit SMEs, or do dominant buyers use this tool to extend payment terms and shift working capital pressure onto upstream suppliers? Corsten's case study of Nestlé Russia illustrates this real-world contradiction[1]. While reverse factoring is theoretically a win-win for all parties, its implementation is accompanied by a passive extension of accounts payable terms.Some suppliers have expressed resistance. van der Vliet et al. [6] further demonstrated through simulation modeling that there is a nonlinear relationship between extended payment terms and the actual financing burden on suppliers. Lengthened payment terms can offset the benefits derived from lower interest rates.

Wuttke et al. [2], based on a multi-case study of six European companies, further supplement this real-world logic. Even if financial calculations show that suppliers stand to benefit, they may still resist. On the one hand, this stems from losses due to extended payment terms; on the other hand, it arises from concerns about signaling. Participating in accounts receivable discounting signals a supplier's financial vulnerability to the customer. At the same time, suppliers face pressure to conform within their industry and to align with other suppliers serving the same buyer. Even if the net benefits are limited, suppliers will still choose to adopt the program. Wuttke et al. [3] empirically validated the above mechanisms using a large sample. Smaller suppliers facing tighter financing constraints adopted the practice more quickly. The greater the expected reduction in financing costs, the faster the adoption. Imitation pressure and normative pressure significantly accelerated adoption. Coercive pressure only took effect when the buyer's potential gains were extremely high. Coercive pressure refers to the supplier's dependence on revenue from that buyer. This suggests that buyers cannot indefinitely force suppliers to accept terms that are disadvantageous to them.

Some literature points out that extending payment terms is not an inherent feature of reverse factoring. It depends on the outcome of negotiations between buyers and sellers. In some cases, payment terms can remain unchanged, with reverse factoring used solely to reduce financing costs by leveraging the buyer's creditworthiness. However, numerous practical cases and empirical evidence indicate that, in real-world scenarios, large buyers often use the implementation of reverse factoring as a bargaining chip. Buyers use this to push for adjustments to payment terms. This has led to divergent views in the literature. Some studies view reverse factoring as an inclusive financial tool for Small and Medium-sized Enterprises (SMEs). Others caution that the benefits of this model are highly dependent on bargaining power and carry the risk of profits being captured by core buyers.

Another practical challenge with reverse factoring is that the business relies heavily on the core buyer's confirmation of receivables. This creates a moral hazard where the buyer may refuse to confirm the receivables. These frictions have spurred efforts to refine the contract structure. The approach involves maintaining the original accounts payable terms while having the core buyer deeply involved in interest rate pricing and directly assuming guarantee obligations. This is the BIF model.

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[1] Corsten, D. (2008). Nestlé Russia Version 2008. IE Business School Case (teaching case). The case documents the implementation of reverse factoring at Nestlé Russia and shows that, although the arrangement is presented as beneficial to all parties, it was in practice accompanied by a unilateral extension of accounts payable terms, which some suppliers resisted. As a teaching case rather than a peer-reviewed academic study, it is used here only as illustrative practical evidence and is therefore not included in the numbered reference list.

The limitations of this type of research include: a prevalence of case studies and simulation analyses, coupled with a limited number of large-sample micro-level empirical studies. Most studies assume that financial institutions bear the risk. There is insufficient discussion of the chain reaction of supply chain risk contagion following the transfer of risk to the core enterprise. A review by Gelsomino et al. [1] points out that most studies focus on a bilateral buyer-supplier binary structure. Research on multi-tier supply chain scenarios remains scarce.

3.3. Buyer-Intermediated Supplier Financing (BIF)

BIF originates from supply chain finance practices on e-commerce platforms. Tunca and Zhu [8] constructed a game theory model based on the newsboy inventory-finance framework. The study conducted empirical analysis using microdata on JD.com SKUs. Key operational assumptions are as follows: the original payment terms between buyers and sellers remain unchanged; the interest rate on the loan is set by the core buyer; the bank extends the loan, with the core buyer providing a guarantee; in the event of product defects, the buyer repays the loan to the bank; and suppliers have the autonomy to choose their borrowing limits, unrestricted by the invoice amount.

By comparison, it is evident that BIF addresses the most acute payment term conflict—a key pain point in reverse factoring—at the institutional level. Theoretical derivations reveal important boundary conditions: BIF can improve the returns for both buyers and sellers only when suppliers face a high risk of product defects. When the defect risk is inherently low, the potential losses the buyer incurs from providing guarantees outweigh the gains from improved financing efficiency. In such cases, BIF actually undermines the buyer's profits. Empirical results show that BIF can lower financing rates, increase order fulfillment rates, and improve overall channel profitability.

It is important to clarify the inherent limitations of research on the BIF model. Although this model has received considerable attention, the body of literature on BIF remains very limited compared to the decades-long academic accumulation on factoring and reverse factoring. Empirical evidence is derived solely from a single online retail platform. External validity in manufacturing, multi-tier supply chains, and different institutional environments has yet to be verified [1]. Wuttke [3] also distinguishes between BIF and conventional platform-based reverse factoring. Conventional reverse factoring typically involves a third-party platform service provider. The BIF model, however, does not involve a third-party intermediary; instead, the buyer is directly and deeply involved in providing guarantees. In actual business practice, the number of implemented BIF cases is far fewer than those of reverse factoring. It is a theoretically valuable, improved supply chain finance model. However, existing research is insufficient to support viewing it as a universally applicable mainstream practice. BIF presents a new challenge: risk concentration in the core enterprise. When a large number of suppliers encounter operational difficulties, the core buyer will face concentrated payment pressures. This may trigger the contagion of supply chain risks. The business relies entirely on the core enterprise's willingness to participate. Evidence of receivables is stored centrally, lacking independent record-keeping. Existing literature merely highlights this phenomenon without conducting in-depth modeling or empirical testing of the risk concentration effect.

The main trajectory of the model's evolution is clear. Traditional factoring relies on supplier creditworthiness. Reverse factoring shifts risk assessment to the buyer but is prone to issues with payment term negotiations. BIF fixes the original payment terms and introduces direct guarantees from the buyer, alleviating conflicts over payment terms but leading to risk concentration at the core enterprise. Each round of improvement resolves old problems while creating new contradictions. Furthermore, whether the model can be

implemented depends not only on contractual terms but also on how suppliers perceive it, what industry peers are doing, and the depth of the buyer's dependence on the core enterprise [2, 3].

4. Blockchain-enabled supply chain finance: enablement pathways, practical constraints, and scope of application

Building on the operational frictions common to traditional models discussed in the previous section—such as centralized claim verification and the ease of document forgery—and in line with the future research directions proposed in the review by Gelsomino et al. [1] regarding the impact of emerging digital technologies on supply chain finance, the value of blockchain has its limits. Beyond the technological benefits, there are practical constraints. Issues such as the authenticity of off-chain data, privacy protection, legal enforceability, implementation costs, and system compatibility all require analysis. So, when does blockchain offer greater value than traditional centralized databases?

Common operational frictions in traditional accounts receivable supply chain finance include three key issues. First, it is difficult to verify accounts receivable. Paper or centralized electronic documents are easily forged, and there is a risk of repeated financing for the same receivable. Second, creditworthiness is difficult to assess across multi-tier supply chains. Traditional factoring and reverse factoring primarily serve only first-tier direct suppliers. Third, the storage of evidence for transaction claims relies heavily on the core enterprise's internal systems, creating moral hazard where the buyer may unilaterally deny the existence of the claim.

From a theoretical perspective, blockchain's potential to empower the sector manifests in three ways. First, information regarding supply, logistics, invoices, and claim verification is distributed and recorded on the blockchain, ensuring tamper-proof records and mitigating risks associated with fraudulent claims and duplicate financing. Second, digital claim certificates can be split, enabling the core enterprise's creditworthiness to extend to second- and third-tier suppliers. Third, multiple parties jointly retain transaction evidence, reducing reliance on a single core enterprise's system.

However, technology is merely a tool. Trustworthiness on-chain does not equate to business trustworthiness. The blockchain cannot automatically guarantee the authenticity of off-chain input data. In reality, there are several hard constraints.

(1) Constraints on the accuracy of off-chain data: original business data—such as invoices and delivery documents—originates from the real world outside the blockchain. If original business documents are forged before being uploaded to the blockchain, simply writing the false data onto the blockchain will not eliminate the risk of business fraud. While blockchain can guarantee that data remains unaltered once on-chain, it cannot prevent forgery before it is uploaded.

(2) Legal enforceability constraints: the legal validity of on-chain digital certificates and smart contracts as electronic evidence, as well as the legal enforceability of debt recovery, varies across different jurisdictions. Technical evidence preservation does not equate to the automatic legal enforceability of claims.

(3) Privacy and governance constraints: recording commercially sensitive transaction information from multiple supply chain participants on the blockchain poses a risk of commercial privacy leaks. The admission of participants to a consortium blockchain, data read/write permissions, and dispute resolution rules require complex off-chain governance mechanisms. Relying solely on code cannot resolve conflicts of interest between organizations.

(4) Implementation costs and system compatibility constraints: the cost of integrating and retrofitting enterprise ERP systems and bank core systems with blockchain networks is high. Small and Medium-sized

Enterprises (SMEs) lack sufficient digital capabilities. The costs of on-chain deployment and operations and maintenance raise the barrier to entry for businesses.

Looking further, when does blockchain offer greater value than traditional centralized databases? In scenarios where there are many participants who do not trust one another, no single trusted third party exists, multiple parties need to jointly retain evidence, and it is necessary to prevent a single entity from tampering with historical transaction records—it is only then that blockchain's distributed evidence storage provides significant incremental value. If a highly trustworthy, well-regulated centralized third party (such as a major bank or a mature platform) already exists within the business context, traditional shared databases combined with robust audit systems can achieve the business objectives. The marginal benefits of blockchain technology are limited, and it may instead unnecessarily increase implementation costs. Gelsomino et al. [1] point out that much of the literature in this field remains at the conceptual level, lacking empirical evaluations of the return on investment for technological investments. This represents a clear research gap.

From this perspective, blockchain can reduce process friction in areas such as rights confirmation and the circulation of certificates. However, it cannot eliminate underlying commercial fulfillment risks or the suppliers' own operational risks. For the technology to be effective, it still relies on reasonable contracts and risk-sharing arrangements. Technology alone cannot resolve financing challenges.

5. Summary of the literature review: consensus, existing disagreements, and specific future research questions

5.1. Existing consensus

First, supply chain finance has altered the basis for assessing credit risk. It substitutes part of the credit risk associated with Small and Medium-sized Enterprises (SMEs) with the transaction creditworthiness of the core enterprise and authentic transaction information. This alleviates information asymmetry and compensates for the shortcomings of traditional collateral-based lending. In emerging markets where credit reporting legal systems are underdeveloped, supply chain finance holds practical value. The evolution from standard factoring to reverse factoring and Business-to-Business Financing (BIF) reflects an iterative process centered on the continuous adjustment of risk assessment targets, payment terms, and risk-sharing rules [1]. At the same time, the effectiveness of a project's implementation cannot be judged solely by financial contracts. Suppliers' adoption is also influenced by institutional factors—such as peer pressure, regulatory pressure, and resource dependence—beyond mere efficiency motives [3].

Second, no single supply chain finance model is universally applicable; its effectiveness depends on boundary conditions. Contract details—including payment terms, the balance of bargaining power, and the party bearing the risk—directly determine the actual benefits SMEs receive. It cannot be taken for granted that supply chain finance will necessarily benefit SMEs. Comparisons of different cases show that even when relying on the credit of the anchor enterprise, differences in contract design can lead to entirely different practical outcomes.

Third, digital technology optimizes processes but cannot replace contract design. Blockchain can address operational pain points, but it cannot eliminate underlying commercial risks. The value of technology is highly dependent on the business context and institutional environment.

5.2. Persisting disagreements

(1) Disagreement over the distribution of benefits from reverse factoring: whether reverse factoring truly benefits SMEs depends on payment term negotiations. The literature presents two perspectives. In some cases, reverse factoring significantly reduces financing costs without extending payment terms. Other evidence indicates that dominant buyers use reverse factoring to push for longer payment terms. The benefits of lower interest rates are offset by the extended payment terms. Wuttke et al. [3] further supplement this with empirical findings showing that even when net financial returns are positive, suppliers may exhibit complex adoption behaviors due to signaling concerns and industry pressures. There remains insufficient large-sample empirical evidence to determine under what conditions reverse factoring can lead to improved net returns for suppliers.

(2) The controversy over the dual nature of risk transfer: reverse factoring and BIFs redistribute risk, transferring supplier risk to the core buyer. Some studies argue that concentrating risk with financially sound core enterprises reduces overall supply chain risk. Other studies argue that this leads to risk concentration. Should the core enterprise face an operational crisis, it could trigger risk contagion throughout the entire supply chain. A review by Gelsomino et al. [1] notes that most existing literature focuses on a binary buyer-supplier structure. There is virtually no empirical evidence supporting risk contagion in multi-tier supply chain scenarios. Most existing research emphasizes efficiency gains, while modeling and empirical evidence regarding risk contagion remain scarce.

(3) Controversy over the external validity of the BIF model: theoretically, BIF mitigates credit term conflicts. However, existing evidence is limited to a single e-commerce platform. Whether the model's conclusions can be replicated in manufacturing, multi-tier supply chains, and different property rights systems remains to be tested. There is a lack of direct empirical comparisons of the comprehensive cost-benefit analysis of BIF versus traditional reverse factoring within the same market context.

(4) Controversy over the actual effectiveness of technology-enabled solutions: discussions on blockchain have primarily focused on conceptual deductions. There is a lack of large-sample empirical studies distinguishing between "theoretical benefits" and actual implementation outcomes. Empirical evidence regarding the incremental value of blockchain compared to traditional shared databases is scarce [1].

5.3. Testable research questions

Given these gaps in the literature, future research could conduct empirical and theoretical analyses centered on the following questions:

(1) The trade-off mechanism between payment terms and financing costs: in reverse factoring scenarios, under what conditions can longer payment terms offset the benefit improvements resulting from lower financing rates? Which firm characteristics, industry institutional conditions, and institutional pressures on suppliers moderate this offsetting effect? A testable question is: To what extent must payment terms be extended before reverse factoring actually results in a loss for suppliers?

(2) Profit allocation and adoption behavior in supply chain finance: supply chain finance generates incremental total surplus within the supply chain. How are these incremental gains distributed among core buyers, small and medium-sized suppliers, and financial institutions? How do suppliers' bargaining power, the industry's competitive landscape, and pressures from industry norms of imitation determine the outcome of profit allocation? It is worth examining whether the new profits ultimately remain with small and medium-sized enterprises or are captured by powerful buyers [3].

(3) Guarantees and supply chain risk contagion: does the buyer guarantee mechanism (BIF model) amplify the contagion effects of supply chain risks? When a core enterprise assumes substantial guarantee obligations for suppliers, does its own operational risk increase? How do risks propagate within a multi-tiered supply

chain structure? It is necessary to examine the negative externalities of risk transfer and weigh the benefits of supply chain finance against systemic risks. This is precisely the "multi-tiered supply chain gap" identified by Gelsomino et al. [1].

(4) Testing the external validity of the BIF model: moving beyond a single e-commerce sample, this study examines the economic effects of BIF in the context of multi-tier manufacturing supply chains. It compares the cost-benefit profiles of BIF and reverse factoring under the same market conditions. The study identifies the industry-specific and firm-level boundary conditions applicable to each model, while also considering suppliers' subjective perceptions and resistance to adoption.

(5) Identification of the true incremental value of blockchain: under what business conditions can blockchain deliver significant operational improvements compared to traditional centralized databases? How do off-chain data quality, the legal and regulatory environment, and implementation and operational costs constrain the actual effectiveness of blockchain-based supply chain finance? Distinguish between theoretical assumptions and real-world outcomes, and quantitatively assess implementation costs and benefits [1].

(6) Moderating Effects of heterogeneity and assessment of long-term consequences: beyond financing rates and loan availability, how does supply chain finance affect the long-term investment, profitability, and survival risks of Small and Medium-sized Enterprises (SMEs)? How do macro-level legal protections and credit reporting systems moderate the impact of supply chain finance on SME financing? Extend the analysis to multi-tier supply chain networks and investigate the differentiated effects across suppliers at various levels.

6. Conclusion

Research on supply chain finance originated from commercial credit theory. Its evolutionary path is clear: identifying pain points, iterating models, exposing new contradictions, and continuing to refine them. Traditional factoring aims to monetize accounts receivable, but its risk control logic remains tied to the SMEs' own creditworthiness. Reverse factoring introduces the credit benefits of the core buyer but faces the risk of benefit erosion resulting from negotiations over payment terms. Furthermore, suppliers' adoption of such arrangements is not determined solely by economic gains but is also constrained by institutional factors such as herd behavior and regulatory pressures. BIF alleviates the aforementioned contradictions by fixing the original payment terms through contract design, but this leads to the problem of risk concentration under the guarantee of the core enterprise [2, 3]. Digital tools such as blockchain can optimize process frictions—such as rights confirmation and the circulation of documents—but cannot resolve the underlying commercial contradictions. Contract design, bargaining power, and risk-sharing mechanisms are the key determinants of business success or failure.

Existing research has established a relatively comprehensive analytical framework. However, significant research gaps remain in areas such as large-sample empirical testing across multiple scenarios, profit-sharing mechanisms, risk contagion effects in multi-tier supply chains, and the true incremental value of blockchain. Future research must simultaneously address both efficiency gains and potential risks. Studies should distinguish between three levels: business models, contract terms, and digital tools. Focusing on the aforementioned issues, further research should clarify the actual role of supply chain finance in SME financing.

References

[1] Gelsomino, L. M., Mangiaracina, R., Perego, A., & Tumino, A. (2016). Supply chain finance: A literature review. *International Journal of Physical Distribution & Logistics Management, 46*(4), 348–366.

[2] Wuttke, D. A., Blome, C., Foerstl, K., & Henke, M. (2013). Managing the innovation adoption of supply chain finance—Empirical evidence from six European case studies. *Journal of Business Logistics, 34*(2), 148-166.

[3] Wuttke, D. A., Rosenzweig, E. D., & Heese, H. S. (2019). An empirical analysis of supply chain finance adoption. *Journal of Operations Management, 65*, 242-261.

[4] Burkart, M., & Ellingsen, T. (2004). In-kind finance: A theory of trade credit. *American Economic Review, 94*(3), 569-590.

[5] Klapper, L., Laeven, L., & Rajan, R. (2012). Trade credit contracts. *The Review of Financial Studies, 25*(3), 838–867.

[6] van der Vliet, K., Reindorp, M. J., & Fransoo, J. C. (2015). The price of reverse factoring: Financing rates vs. payment delays. *European Journal of Operational Research, 242*(3), 842–853.

[7] Klapper, L. (2006). The role of factoring in financing small and medium enterprises. *Journal of Banking & Finance, 30*(11), 3111–3130.

[8] Tunca, T. I., & Zhu, W. (2017). Buyer intermediation in supplier finance. *Management Science, 63*(4), 1-20.