Effect of supply chain finance on supply chain trade

Abstract:

This research paper investigates the influence of supply chain finance (SCF) on increasing countries' involvement in supply chain trade (SCT). Utilizing a dataset of 1,755,930 country-pair observations from 1995 to 2020, the study examines how SCF, particularly factoring services in source countries, impacts SCT. SCT is measured by the share of domestic value added in gross exports, indicating a country's contribution to international trade. Factoring, a key component of SCF, enhances liquidity by allowing firms to sell accounts receivable, thereby meeting working capital requirements and alleviating financial constraints. The findings show that SCF significantly boosts a country's SCT, especially in industries that are more dependent on liquidity, a result that remains robust after addressing endogeneity and conducting various robustness checks. During the financial crisis, SCF also supports SCT growth, though its impact is relatively smaller. Our findings suggest important implications for policymakers, financial institutions, and businesses.

JEL codes: F1, F2, F6

Keywords: Supply chain finance; Supply chain trade; Value added trade; International trade; Gravity model

1. Introduction

The escalating intricacy and globalization of supply chains have fundamentally altered the dynamics of international trade, thereby facilitating the emergence of supply chain trade (SCT). SCT, defined by the production and dissemination of goods and services across diverse nations, frequently entails the incorporation of international inputs within production methodologies. As global value chains (GVCs) proliferate, enterprises increasingly depend on inter-firm collaborations to orchestrate the movement of materials, services, and information across national boundaries (Santistevan, 2022). However, this interdependence has concurrently amplified financial vulnerabilities, liquidity challenges, and operational inefficiencies. In this milieu, supply chain finance (SCF) has arisen as an essential apparatus for bolstering SCT by delivering financial solutions that enhance liquidity, minimize transaction expenses, and alleviate risks throughout the supply chain (Jinjarak, 2015)

SCF encompasses a diverse array of financial strategies, including trade credit, factoring, and reverse factoring, all aimed at augmenting cash flow and alleviating the financial strain on enterprises engaged in SCT (Xu et al., 2018). Trade credit is a pivotal component of SCF, allowing firms to extend payment terms and improve liquidity. It serves as a vital mechanism for small and medium-sized enterprises (SMEs) to manage cash flow and maintain operational efficiency. Liquidity-saving mechanisms in trade credit networks can mitigate risks and enhance supply chain resilience by reducing outstanding exposures and payment terms. Factoring, a form of SCF, enables SMEs to access capital by selling their accounts receivable. This is particularly beneficial in regions with limited financial sector support, facilitating SMEs' integration into global supply chains (Auboin et al., 2016). Meanwhile, reverse factoring is a financial arrangement where a company enables early payment of its trade credit obligations to its suppliers. By capitalizing on accounts receivable or prolonging payment durations, SCF assists firms—particularly SMEs—in surmounting liquidity challenges and enabling more efficient trading. This is particularly critical within the context of SCT, wherein payment delays or financial bottlenecks can disrupt production workflows and diminish competitive advantage. Notwithstanding its growing significance, empirical investigations into the direct impacts of SCF on SCT remain scarce, particularly regarding the manner in which SCF practices enhance firms' engagement in global trade networks.

This study seeks to bridge this research lacuna by examining the influence of SCF on SCT. Utilizing a comprehensive dataset that encompasses 75 countries from 1995 to 2020, this research evaluates the role of SCF in facilitating SCT through improved access to working capital and diminished financial constraints. The analysis employs the gravity model framework to elucidate the effects of SCF on SCT, while accounting for both country-specific and industry-specific determinants that shape trade relationships.

The findings reveal several key insights. First, SCF significantly boosts a country's SCT, particularly in industries with higher liquidity dependence. This result remains robust even after addressing endogeneity and performing a series of robustness checks, confirming that SCF plays a critical role in facilitating participation in SCT. Additionally, the study finds that the positive

effect of SCF on SCT is more pronounced when the destination countries face heightened levels of political risk, investment risk, and uncertainty. This suggests that firms in riskier environments are more likely to rely on SCF mechanisms, such as factoring, to mitigate financial vulnerabilities and ensure smooth trade operations.

By investigating the interrelationship between SCF and SCT, this study makes a significant contribution to the existing literature on GVCs and international finance. It provides robust empirical evidence on how SCF practices—particularly factoring—enhance participation in SCT by improving liquidity, reducing financial constraints, and enabling firms, especially SMEs, to navigate complex global trade networks more effectively. The study's findings emphasize the role of SCF as a vital financial tool that not only facilitates smoother trade operations but also strengthens firms' resilience against financial disruptions and uncertainties. The implications of these findings are substantial for policymakers, financial institutions, and businesses.

The rest of the paper proceeds as follows. Section 2 provides literature review and develops hypotheses. Section 3 describes the model, data, and estimation method. Section 4 reports empirical results and discussion. Section 5 concludes the paper.

2. Literature review and hypothesis development

2.1. Supply chain trade

Supply-chain trade, which refers to the trade linked to international production networks, has been a significant driver of global economic changes over the past few decades. This phenomenon has transformed traditional domestic production networks into modernized global ones, leading to increased interdependence among nations and a dramatic shift in the structure of global trade patterns (Baldwin & Lopez- Gonzalez, 2015).

While various terms exist for supply-chain trade, the core concepts are universal. There are three fundamental concepts in supply-chain trade: (i) importing for production, (ii) importing for export, and (iii) value-added trade. The most comprehensive view of supply-chain trade is "importing to produce," which includes any production utilizing foreign inputs as part of an international production network. A policy-relevant subset of "importing to produce" involves intermediates used for exporting, known as "importing to export." This concept aligns more closely with the popular understanding of GVCs. Here, the importing country functions as a node within a larger international production network, even if the network is informal and not centrally coordinated. The key feature is that foreign intermediates are used to produce goods and services that are then exported (Hummels et al., 2001).

Importing for export is a recursive concept, leading to pervasive double counting. A nation's imported intermediates from a specific partner often include intermediates from third countries and even from the nation itself. When this recursion is fully traced to identify the origin of all primary factor inputs in exports, it results in factor-content trade, now referred to as "value-added trade" (Koopman e t al., 2010; Johnson & Noguera, 2012). To understand value added trade, two accounting identities are crucial: the sale value of a product equals the cost of

intermediate inputs (both domestic and imported) plus the direct domestic value added, and the sum of the value added accumulated domestically and abroad.

The emergence of global supply chains has allowed emerging market economies to become key players in high-technology exports, significantly boosting their trade interconnectedness and altering the global trade landscape (Riad et al., 2012). China, in particular, has emerged as a major trading hub, reflecting not only the size of its trade but also the increasing number of its significant trading partners. The reduction in international trade costs due to technological progress and trade liberalization has further intensified the fragmentation and internationalization of production, leading to an increase in the trade of intermediate goods. This has necessitated the tracking of global trade chains and the study of factors such as export and import value-added embodied in goods and services (Baldwin & Lopez- Gonzalez, 2015). Theoretical and empirical evaluations of value-added trade models have highlighted the importance of these chains in shaping industrial and trade policies, particularly for countries like Russia, which aim to expand their high-value exports and improve their production structures. Additionally, global supply chain linkages have been shown to modify countries' incentives to impose import protection, with empirical evidence suggesting that final goods tariffs decrease with the domestic content of foreign-produced final goods and the foreign content of domestically-produced final goods (Blanchard et al., 2016). However, the rise of nationalism, protectionism, and regional disintegration risks poses challenges to global trade, as evidenced by the significant number of trade restrictions imposed by governments worldwide (Lehmacher, 2017).

2.2. Supply chain finance and factoring

In this section, we review the literature on SCF and its specific practices. The earliest research on SCF dates back to the 1970s, with Budin and Eapen (1970) demonstrating how policy changes related to trade credits and inventories impact the net cash flow generated during business operations. However, a more formal definition of SCF only emerged in the 21st century. Stemmler (2002) emphasized that the key to SCF is integrating capital flows into the supply chain, categorizing SCF as an important component of supply chain management. As SCF evolved, its definitions became more practical. Wuttke et al. (2016) described it as an alternative collaborative financing method that can benefit supply chain partners.

SCF is a widely used and recently innovative financing practice whose popularity stems from its unique advantages. The first benefit is the reduction in financing costs. Grüter and Wuttke (2017) examined how SCF's flexibility reduces suppliers' financing costs. Additionally, van der Vliet et al. (2015) explored how extended payment terms, often induced by buyers, affect suppliers' ability to benefit from SCF, finding that longer payment delays negatively impact suppliers' capacity to reduce financing costs. The second benefit of SCF is providing a new financing channel for firms under capital pressure. For instance, Lekkakos and Serrano (2016) demonstrated that SCF enables suppliers to unlock over 10% of their working capital by allowing earlier payments, highlighting SCF's crucial role in helping small suppliers secure necessary operating funds. The third benefit is enhanced sustainability. Chen et al. (2019)

conducted a case study on a SCF program in JD.com, one of China's largest e-commerce platforms, and found that JD.com's participation in SCF has fostered close relationships with its supply chain partners. This collaboration has strengthened their business systems and increased their competitive advantage.

SCF typically involves three common forms of practice: trade credit, factoring, and reverse factoring (Wang et al., 2020). Trade credit is the most basic form, where accounts receivable are generated when suppliers allow customers to delay payment for goods or services (Liu et al., 2020). This approach significantly alleviates financial pressure on customers. However, suppliers providing trade credit may face liquidity crises, leading to the development of factoring and reverse factoring based on trade credit (Wang et al., 2020). Factoring involves external financing where suppliers sell their accounts receivable at a discounted rate to third-party factoring institutions (Mol-Gómez-Vázquez et al., 2018). Reverse factoring occurs when a reputable buyer informs a financial institution of its payment obligations to selected suppliers, allowing the suppliers to borrow at lower interest rates based on the value of the accounts receivable (Klapper, 2006). Unlike customer-initiated reverse factoring, factoring is initiated by suppliers before being adopted by customers.

Our study defines SCF primarily based on factoring. The main reason is that factoring is the most widely used form of SCF in practice (Tian et al., 2020). Previous literature indicates that factoring has become not only the primary source of operating capital for SMEs in many economies but is also extensively adopted by large-scale firms (Bilgin & Dinc, 2019). Despite its significance, the use of factoring as a source of external financing is rarely addressed in the literature (Tian et al., 2020).

While limited, existing empirical research has examined the factors influencing the implementation of factoring from the perspective of supplier firms' internal motivations and external conditions. Regarding internal motivations, Soufani (2002) analyzed the types of UK-based firms that used factoring for financing and found that younger and smaller firms were more inclined to use factoring to alleviate financial difficulties. Tian et al. (2020) discovered that suppliers' attitudes towards risk influenced their preference for different types of factoring. Concerning external conditions, Klapper (2006) found that factoring was more prevalent in countries with higher economic growth and better credit information, based on country-level data from Mexico. Mol-Gómez-Vázquez et al. (2018) analyzed a survey dataset from 25 European countries and found that firms were more likely to use factoring in countries with weak creditor protection, political instability, and high enforcement costs. Recently, blockchains and financial institutions have been recognized for their significant role in promoting factoring (Li et al., 2020).

Factoring allows companies to sell their invoices at a discount to obtain immediate cash, which can be crucial for meeting current obligations and investing in growth opportunities. This method is especially beneficial for SMEs that often face limited access to external financing sources due to high costs and stringent terms in money and capital markets (Bradic-Martinovic et al., 2021). By using factoring, businesses can maintain smaller cash balances, thus freeing up

more funds for investment in their core activities and growth (Flores-Ureba et al., 2023). Additionally, factoring helps manage accounts receivable effectively, ensuring timely payments for goods or services sold, which in turn supports solvency and allows businesses to focus on their primary operations (Chen, 2022). Despite the costs involved, many entrepreneurs are increasingly opting for factoring due to its ability to mitigate payment backlogs and prevent bankruptcies. Furthermore, factoring can offer extended debt payment periods to buyers, improving the supplier's liquidity and providing access to additional services offered by factors (Zhu & Ou, 2023).

2.3. Effect of supply chain finance on supply chain trade

SCF, particularly factoring, significantly influences SCT by enhancing liquidity, optimizing cash flow, and fostering collaboration among supply chain partners. Factoring, which involves selling receivables to a third party at a discount, provides immediate working capital to suppliers, thereby improving their financial stability and enabling them to meet operational demands promptly. This financial tool reduces the time required to collect receivables and minimizes the need for costly short-term borrowing, enhancing the overall efficiency and competitiveness of businesses.

Moreover, SCF strategies, including reverse factoring, allow suppliers to benefit from the buyer's lower short-term borrowing rates in exchange for extended payment terms, thereby improving cash flow management and reducing financial strain on suppliers (Beyer & Herzog, 2021). However, the advantages of reverse factoring depend on various financial variables such as interest rates, credit ratings, and the business cycle position, which can turn win-win situations into win-lose scenarios for suppliers if not carefully managed.

SCF also facilitates better coordination and transparency among supply chain partners by streamlining payment processes and sharing financial information, which reduces supply chain disruptions and enhances reliability. The integration of advanced information technologies, such as blockchain, further optimizes resource sharing and data exchange, mitigating inherent risks like credit risk, which is crucial for the financial sustainability of the supply chain (Almeida et al., 2024). However, the complexity of credit default risk contagion among supply chain enterprises necessitates robust financial risk management to ensure sustainable development (Wang et al., 2022).

Analytical methods to quantify the value of SCF strategies reveal that while they positively impact cash-flow performance and operational efficiency, they must be coupled with the right financial strategies to generate sustainable profits (Biçer, 2023). Furthermore, SCF has been shown to promote the total factor productivity of enterprises, with its influence varying across different ownership types, firm sizes, regions, and degrees of supply chain concentration (Ci et al., 2023). The strategic implementation of SCF practices can provide businesses with a competitive edge by enhancing operational efficiency, reducing costs, and managing risks effectively (Gu & Liang, 2022). Overall, the adoption of SCF, including factoring, plays a pivotal role in improving supply chain trade by providing financial stability, optimizing cash

flow, and fostering collaboration, although it requires careful consideration of financial variables and risk management to maximize its benefits.

Based on the above discussion, we raise the following hypotheses:

H1: The effect of SCF on SCT is more pronounced in industries with higher external financial dependence.

3. Data description and model specification

3.1. Data and variables

3.1.1. Supply chain finance

The measurement of SCF is indeed a critical issue in empirical analysis, particularly due to the lack of detailed transaction-level data for most countries. SCF, which includes mechanisms like trade credit, pre-shipment financing, dynamic discounting, and inventory financing, plays a vital role in enhancing trade efficiency, reducing costs, and improving working capital accessibility for companies (Tchamy et al., 2018; Alora & Barua, 2019). Given the absence of granular data, using total factoring volume to GDP (%) from Factors Chain International as a proxy for SCF is a pragmatic approach. Factoring volume, which represents the total value of receivables purchased by financial institutions, can serve as a reasonable indicator of the extent to which SCF mechanisms are utilized within an economy. This method aligns with the broader trend of leveraging available macroeconomic indicators to infer microeconomic activities, as seen in other empirical studies that use cross-country samples to analyze relationships like aid and trade. The use of such proxies is particularly relevant in developing economies, where data gaps and poor data quality are prevalent, making it challenging to measure progress accurately (Khalid et al., 2020).

3.1.2. External financial dependence

Based on existing literature, external financial dependence (EFD) is used to measure industry financial vulnerability, reflecting the degree of short-term financing needs across industries (Levine et al., 2018). This indicator is defined as the percentage of total assets financed by trade credit. Its value is derived from the work of Fisman and Love (2003), who calculated this percentage using data from American firms between 1980 and 1989. In studies employing the Rajan-Zingales approach, it is common practice to use industry-level indicators calculated with US data (Foley & Manova, 2015; Minetti et al., 2021). This approach is adopted for several reasons. Firstly, firm-level data necessary for calculating EFD are often unavailable for many countries, making US data a convenient choice for empirical research (Manova, 2013). Secondly, the developed nature of US financial markets ensures that measures based on US data accurately reflect the true external liquidity needs across industries (Minetti et al., 2021). Thirdly, using historical US firm data helps to mitigate endogeneity concerns (Bilir et al., 2019). Finally, the Rajan-Zingales approach does not require that industries in different countries have identical external financial dependence, but rather that their rankings in terms of external liquidity dependence remain consistent across countries (Manova, 2013). This indicator

effectively captures the technological dependence of industries on external liquidity, making it suitable for ranking industries globally.

3.1.3. Supply chain trade

The methodology of Koopman et al. (2010) for defining the dependent variable SCT, which stands for the importing partner share of domestic value added (DVA) in gross exports, is a crucial aspect of understanding GVCs and trade dependencies. This approach is particularly relevant in the context of analyzing how countries integrate into the global economy and the extent to which they rely on foreign markets for their economic output. The OECD TiVA 2023 database provides comprehensive data on this variable, allowing for a detailed examination of trade patterns and dependencies.

3.2. Identification strategy

We modify the identification strategy proposed by Rajan and Zingales (1998) to empirically assess whether SCF impacts SCT. This well-established approach leverages the variation in supplier trade credit levels across original countries and the differences in the level of financial development across countries. This method combines cross-country differences in the availability of SCF with exogenous cross-country differences in financial development. This reduces concerns about endogeneity caused by omitted variables and reverse causality (Bilir et al., 2019; Zeng et al., 2023). Additionally, this approach helps identify the channels through which the effects occur (Choi et al., 2018; Huang et al., 2020). In this study, if SCF promotes SCT by easing liquidity constraints, we anticipate that SCF will have a more significant DVA facilitation effect in industries that are more reliant on external liquidity.

A modified gravity model is presented below to investigate the effects of SCF on SCT:

$$SCT_{ijkt} = \beta_0 + \beta_1 SCF_{it} \times EFD_k + \beta_2 GRA + \mu_{it} + \mu_{jt} + \mu_k + \varepsilon_{ijkt.} \quad (1)$$

In the provided model, superscripts *i* and *j* are, respectively, the source and destination countries, *k* is the industry, and *t* denotes the year. SCT_{ijkt} is the importing partner share of DVA in gross exports of industry *k* in country *i* to partner country *j* in year *t*.

The interaction term $SCF_{it} \times EFD_k$ serves as the key explanatory variable. Here, SCF_{it} represents total factoring volume to GDP. EFD_k denotes the degree of external financial dependence for industry *k*. A significantly positive estimated coefficient β_1 would indicate that industries with higher external liquidity demands benefit more, aligning with our expectations.

In our study, *GRA* refers to a set of bilateral factors commonly used in gravity models. These factors include weighted distance (*D*), shared religious beliefs (*comrelig*), common colonizers post-1945 (*comcol*), an official language in common (*comlang_off*), and participation in the same regional trade agreements (*rta*). Physical distance and shared borders indicate shipping costs, while common language, religion, and colonial history indicate historical and cultural connections. Regional trade agreements are considered for their role in reducing tariffs. The data for these variables are sourced from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).

The variable μ_{jt} represents destination-year fixed effects, controlling for the influence of factors that vary at the destination-year level. Similarly, μ_{it} is the source-year fixed effect, which controls for factors varying at the source-year level and absorbs the effect of SCF_{it}. The variable μ_k represents the industry fixed effect, and EFD_k, which does not change over time, is absorbed by μ_k. The error terms are denoted as ε_{ijkt}. The estimation results follow the approach of Egger and Tarlea (2015), employing multi-level clustering. Due to the relatively high occurrence of zero observations in our GVC accounts sample, we apply the PPML estimator, as commonly proposed by Silva and Tenreyro (2006) in the trade literature.

A comprehensive description of these variables is provided in Table A1 in the Appendix. The final dataset, after removing outliers and missing data, includes 1,755,930 observations across 75 countries from 1995 to 2020. Table 1 presents a statistical summary of these variables.

Table 1: Statistical summary

	count	mean	sd	min	max
Panel A: Dependent variable					
SCT	1755930	0.01	0.04	0.00	1.00
Panel B: Interesting variable					
SCFxEFD	1755930	0.01	0.02	-0.01	0.24
SCF	1755930	0.02	0.04	0.00	0.16
EFD	1755930	0.39	0.37	-0.08	1.49
Panel C: Control variables					
D	1755930	8.42	1.04	1.95	9.90
comlang_off	1755930	0.08	0.27	0.00	1.00
comcol	1755930	0.03	0.18	0.00	1.00
comrelig	1755930	0.15	0.25	0.00	0.99
contig	1755930	0.03	0.18	0.00	1.00
rta	1755930	0.32	0.47	0.00	1.00

4. Empirical results

4.1. Baseline results

In Table 2, we present our baseline results. Column (1) does not include any control variables, whereas column (2) includes all control variables. The estimated coefficients of the core explanatory variable *SCFxEFD* are significantly positive across all columns. This indicates that higher levels of SCF lead to increased DVA in industries with higher external liquidity dependence, confirming our prediction. These results confirm our hypothesis H1.

The examination of control variables on SCT reveals a multifaceted landscape influenced by both facilitating and inhibiting factors. Geographical contiguity (*contig*) plays a significant role in strengthening SCT by reducing transportation costs and enhancing logistical efficiency, as evidenced by the increased participation of African Regional Economic Communities (RECs) in SCT, albeit still lagging behind other regions (De Melo & Twum, 2021). A common official language (*comlang_off*) and shared religion (*comrelig*) further bolster SCT by simplifying communication and fostering trust among trading partners, which is crucial for the seamless

integration of supply chains (Doan, 2023). Historical ties, such as having a common colonizer post-1945 (*comcol*), also contribute positively by providing a shared legal and institutional framework that can facilitate smoother trade relations. Regional trade agreements (*rta*) are particularly impactful, as they often include provisions for the free movement of goods, services, and factors of production, thereby reducing trade barriers and promoting economic integration (Thang et al., 2021). For instance, the African Continental Free Trade Area aims to spearhead GVC trade among African countries, highlighting the importance of regional agreements in enhancing SCT (De Melo & Twum, 2021). Conversely, bilateral distance (*D*) acts as a significant barrier to SCT by increasing transportation costs and complicating logistics, which can deter firms from engaging in cross-border trade (Wignaraja, 2015). This is particularly challenging for SMEs, which often lack the resources to overcome these barriers compared to larger firms that benefit from economies of scale.

Table 2: Baseline results

VARIABLES	(1) SCT	(2) SCT
SCFxEFD	0.32**	0.32**
	(0.147)	(0.132)
D		-0.50***
		(0.003)
comlang_off		0.62***
		(0.008)
comcol		0.72***
		(0.017)
comrelig		0.41***
		(0.011)
contig		0.79***
		(0.007)
rta		0.87***
		(0.006)
Constant	-3.65***	-0.21***
	(0.003)	(0.022)
Observations	1,755,930	1,755,930
Source-year FE	YES	YES
Destination-year FE	YES	YES
Sector FE	YES	YES

Standard errors are clustered at (and may be correlated within) base groups (source, destination, sector, and year), as well as every combination of the three.

*** p<0.01, ** p<0.05, * p<0.1

The Rajan-Zingales approach focuses on examining the heterogeneous effects of SCF at different levels of EFD, which helps to some extent to alleviate potential endogeneity bias. However, the core explanatory variable, the interaction term, could still be endogenous if EFD reflects other industry characteristics or if SCF reflects other source features.

To address whether EFD captures other industry characteristics, we interact a set of additional industry characteristics with SCF in Equation (1) and include these interaction terms as additional controls. The first characteristic is long-term external finance dependence (*LEFD*), defined as the fraction of capital expenditure not financed with cash flow from operations, representing the external funding needed for long-term investment projects (Manova et al., 2015). If SCF also helps ease long-term external finance needs and EFD correlates with FD, the coefficient of the interaction term *SCFxEFD* in Equation (1) will be misestimated. Second, Raddatz (2006) notes that industries with high liquidity needs might be intensive in human capital. Therefore, we include interaction between human capital intensity (*HCI*) and SCF. Additionally, following Manova (2013), we add interaction terms of physical capital intensity (*PCI*) and natural resource intensity (*NRI*) with SCF. In Table 3, whether these interactions are included individually (columns (1) – (4)) or simultaneously (column (5)), the estimated coefficients of the core explanatory variable *SCFxEFD* remain significantly positive and are larger than those in the baseline estimation. This indicates that EFD is unlikely to capture the effects of other industry characteristics.

For the newly added interaction terms, only the estimated coefficients of *SCFxHCI* and *SCFxNRI* remain stable across different settings. In Tables 3, the estimated coefficients of *SCFxHCI* and *SCFxNRI* are significantly positive, suggesting that SCF has a greater effect on SCT in industries with higher human capital density and natural resource intensity. This may be because industries with high human capital intensity also rely more on external funds, amplifying the impact of SCT (Raddatz, 2006).

Table 3: Estimation result with controlling industry characteristics

	(1)	(2)	(3)	(4)	(5)
VARIABLES	SCT	SCT	SCT	SCT	SCT
SCFxEFD	0.55**	0.35**	0.38**	0.46***	1.32***
	(0.253)	(0.147)	(0.137)	(0.136)	(0.277)
SCFxLEFD	-0.16				-0.41**
	(0.158)				(0.174)
SCFxPCI		-1.29			-13.18***
		(2.181)			(3.214)
SCFxHCI			0.22***		1.66***
			(0.240)		(0.354)
SCFxNRI				0.55***	1.06***
				(0.144)	(0.173)

Constant	-0.21***	-0.21***	-0.21***	-0.21***	-0.24***
	(0.022)	(0.023)	(0.023)	(0.022)	(0.023)
Observations	1,755,930	1,755,930	1,755,930	1,755,930	1,755,930
GRA variables	YES	YES	YES	YES	YES
Source-year FE	YES	YES	YES	YES	YES
Destination-year FE	YES	YES	YES	YES	YES
Sector FE	YES	YES	YES	YES	YES

Standard errors are clustered at (and may be correlated within) base groups (source, destination, sector, and year), as well as every combination of the three.

*** p<0.01, ** p<0.05, * p<0.1

4.2. Endogeneity problem

Endogeneity is indeed a critical issue in the analysis of SCF, particularly within the context of SCT. One primary source of endogeneity is reverse causality, which arises because firms within SCT often have established, close relationships, making them more likely to use SCF from other members in the chain. This is supported by findings that SCF use increases with the length of firm-to-firm relationships, especially in environments with weaker contract enforcement and for differentiated goods. Additionally, firms within SCT may have stronger reputations, further facilitating their use of SCF. Another significant source of endogeneity is omitted variable bias. For instance, trade-related government expenditure can influence SCT, but if such expenditures are not accounted for, the estimated effect of SCF on SCT may be biased (Shingal et al., 2021). Similarly, the institutional factors and financial development levels of a country can affect SCF availability, and failing to include these variables can lead to incorrect inferences about the relationship between SCF and SCT.

Factoring is significantly influenced by the legal environment, particularly creditor rights and contract enforcement. Research indicates that countries with robust creditor rights and effective contract enforcement mechanisms exhibit higher volumes of factoring, suggesting that these legal variables are crucial for the growth of factoring markets (Mwakujonga, 2015; Mol-Gómez-Vázquez et al., 2018). Improved contract enforcement not only increases the level of factoring but also extends the maturity of international debt, highlighting its importance in international lending (Mina, 2006). However, the relationship between contract enforcement and economic outcomes is complex. Imperfect enforcement can sometimes be optimal, especially in less developed countries (LDCs), where it may balance the benefits of attracting potential counter-parties with the drawbacks of impeding exits from unfavorable contracts (Anderson & Young, 2006). Additionally, the enforceability of contracts in financial markets is often linked to aggregate behavior, where high default rates can undermine enforcement capacity and affect credit supply, potentially leading to credit crunches. In environments where enforcement is costly, principals may use strategies like backloading payments to ensure compliance, which can influence firm dynamics and economic development by leading to sub-optimal technology

choices and inefficient capital dispersion (Popov, 2014). Therefore, while strong contract enforcement generally supports factoring and credit markets, the optimal level of enforcement may vary depending on the economic context and the specific dynamics of the market.

Since this study primarily focuses on the impact of factoring - a proxy of SCF- on suply chain trade, it is crucial that the instrumental variables employed reflect the level of contract enforcement in the source country. First, we utilize the cost to enforce contracts that is recorded as a percentage of the claim value. Second, we use the score for cost to enforce contracts benchmarks economies with respect to the regulatory best practice on the indicator. Data is collected from Doing Business, World Bank.

The exclusion restriction in the context of studying the impact of factoring on supply chain trade, particularly through the lens of contract enforcement, is crucial for ensuring that the instrumental variables used are valid and not correlated with the error term in the regression model. The first instrumental variable, the cost to enforce contracts as a percentage of the claim value, directly reflects the financial burden of legal enforcement in the source country. This measure is significant because high enforcement costs can deter firms from engaging in complex contractual agreements, thereby influencing their reliance on mechanisms like factoring to manage receivables and mitigate risks associated with trade finance (Boehm, 2022). The second instrumental variable, the score for cost to enforce contracts, benchmarks economies against regulatory best practices, providing a comparative perspective on the efficiency and effectiveness of legal institutions in different countries. This score is essential as it highlights the relative ease or difficulty of contract enforcement, which can impact firms' decisions to engage in SCF solutions like factoring. The exclusion restriction ensures that these variables are only influencing the dependent variable (SCF) through their impact on the independent variable (factoring) and not through other channels. For instance, in the Moneual case, the lack of due diligence and the need for better digitalization in trade finance underscore the importance of robust contract enforcement mechanisms to prevent fraud and ensure smooth transactions (Han et al., 2020). Additionally, the legal structure and practical challenges of factoring in countries like Iran, where clear legal bases are lacking, further emphasize the need for strong contract enforcement to facilitate effective SCF.

To ensure the validity of our instrumental variables (IVs), we conduct various endogeneity tests, with the results shown in Table 4. Firstly, the Hausman test of endogeneity reveals a significant χ^2 statistic in the model using SCF, indicating that endogeneity in SCF may pose a challenge in our analysis. Consequently, we must address the potential endogeneity issue. Secondly, the LM statistics from the under-identification test show significant χ^2 statistics, confirming that our IVs are appropriate. Lastly, the Cragg-Donald Wald F-statistic significantly exceeds the critical value at the 10% level, suggesting that our IVs are strong enough to mitigate the endogeneity problem. These tests collectively provide evidence supporting the validity of our instrumental variables.

Table 4: Endogeneity test

(First stage model)	Coefficient
	SCFxEFD
Hausman test of endogeneity [χ^2]	48.293
	(0.000)
Kleibergen-Paap LM statistic	3.3e+04
(Under-identification test)	(0.000)
Cragg-Donald Wald F-statistic	9.1e+04
(Weak identification test)	

Note: we report endogeneity tests of *SCFxEFD* on *SCT* from the specification using 2SLS. p-values are in brackets. Stock-Yogo weak ID test critical values at 10% maximal IV size is 16.38.

Subsequently, we employ IV estimation using STATA's ivpoisson command and present the outcomes in Table 5[1]. Given that this command is incompatible with high-dimensional fixed effects, we retain our sample size by reducing the set of fixed effects. Columns (1) and (2) display the regression findings of SCT on SCF with the two IVs, respectively. Our conclusions regarding the impact of SCF on SCT remain consistent, but their effects become more pronounced when we account for the endogeneity issue. This evidence suggests a downward bias in the estimated effect of SCF in our initial baseline estimation results. Such bias is a common occurrence in trade literature; for instance, Zeng et al. (2023) highlighted that the influence of SCF on SCT, when estimated using IV methods, is significantly greater than when estimated without IV.

Table 5: Second stage IV estimation results

	(1)	(2)
VARIABLES	SCT	SCT
SCFxEFD	1.32***	0.42***
	(0.327)	(0.232)
Constant	-3.48***	-3.47***
	(0.030)	(0.030)
Observations	1,165,703	1,165,703
GRA variables	YES	YES
FE	NO	NO

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
A set of GRA variables is included.

4.3. Robustness check

We utilize alternative measures to assess external liquidity needs, specifically focusing on two indicators that reflect an industry's reliance on external liquidity. The first measure is the ratio of inventories to sales (*Inventory*), where a higher ratio suggests that a smaller portion of

[1] The estimation results of the first stage are reported in Table A4 of the Appendix.

inventory investment can be financed through current revenue, indicating greater short-term external liquidity dependence (Raddatz, 2006). The second measure is the ratio of short-term debt to sales (*Debt*), which represents both the actual use of external liquidity and a firm's capacity to meet its current liabilities. A higher *Debt* ratio also signifies a greater dependence on external liquidity. The Invent measure is sourced from Kroszner et al. (2007), while Debt is based on Raddatz (2006), both of which were calculated using data from U.S. firms between 1980 and 1989. The median ratio for firms within the same ISIC code was used as the industry indicator. In columns (1)-(2) of Table 6, the findings suggest that SCF is particularly effective in promoting SCT in industries with a high dependence on external liquidity.

Next, we employ trade credit as an alternative measure of SCF. To do this, we utilize balance of payments data from the IMF to create our trade credit metric as proposed by Zeng et al. (2023). Specifically, we use the asset section, which captures the source country's cash in advance and accounts receivable, as a proxy for trade credit. Results reported in column (3) of Table 6 is consistent with that in column (1) of Table 2.

Table 6: Robustness check

	(1)	(2)	(3)
VARIABLES	SCT	SCT	SCT
SCFxInventory	0.47***		
	(0.039)		
SCFxDebt		0.49***	
		(0.052)	
TradecreditxEFD			0.35***
			(0.101)
Constant	-3.69***	-3.68***	-3.68***
	(0.003)	(0.003)	(0.003)
Observations	1,755,930	1,755,930	1,391,033
Source-year FE	YES	YES	YES
Destination-year FE	YES	YES	YES
Sector FE	YES	YES	YES

Standard errors are clustered at (and may be correlated within) base groups (source, destination, sector, and year), as well as every combination of the three.
*** p<0.01, ** p<0.05, * p<0.1

5. Conclusion

This study provides a detailed and comprehensive analysis of the pivotal role of SCF in enhancing countries' participation in SCT. By utilizing an extensive dataset of 1,755,930 observations over a period from 1995 to 2020, the research demonstrates how SCF—particularly factoring services—significantly bolsters a country's involvement in global trade by addressing liquidity challenges and alleviating financial constraints. Factoring, in particular, emerges as a crucial financial mechanism, especially for SMEs, enabling them to integrate more effectively into GVCs.

The findings indicate that SCF has a disproportionately positive impact on SCT in industries with greater liquidity dependence. Furthermore, this effect is magnified in destination countries that experience higher levels of political risk, investment risk, and uncertainty. This highlights SCF's role in mitigating trade-related risks and fostering more stable international trade relationships. While the global financial crisis reduced the overall effectiveness of SCF in promoting SCT, the mechanism nonetheless played a crucial role in sustaining trade flows during this period of economic turmoil.

The results of this study offer several important implications for policymakers, financial institutions, and business leaders. Policymakers aiming to boost their countries' participation in global trade should prioritize policies that promote the development and widespread accessibility of SCF solutions, particularly factoring services. By fostering a supportive financial ecosystem, governments can help businesses—especially liquidity-dependent SMEs—overcome the barriers to participating in GVCs. For businesses, especially SMEs, SCF mechanisms provide critical financial flexibility, enabling firms to manage working capital, navigate complex international supply chains, and mitigate risks related to political instability and market volatility.

Overall, this study underscores the vital importance of SCF in facilitating deeper integration into global trade networks and enhancing economic resilience in the face of financial, geopolitical, and market challenges. The research highlights SCF as an indispensable tool for strengthening supply chain resilience and ensuring the smooth functioning of international trade. Future research could explore the long-term impacts of SCF on trade patterns, its role in fostering sustainable growth, and its effectiveness across diverse economic sectors and geographic regions.

Reference

Almeida, L., Tavares, F., & Almeida, L. (2024). Supply Chain Finance Credit Risk. In *Reference Module in Social Sciences*. Elsevier. https://doi.org/10.1016/B978-0-443-13701-3.00021-9

Alora, A., & Barua, M. K. (2019). Barrier analysis of supply chain finance adoption in manufacturing companies. *Benchmarking: An International Journal*, *26*(7), 2122–2145. https://doi.org/10.1108/BIJ-08-2018-0232

Anderson, J. E., & Young, L. (2006). Trade and Contract Enforcement. *The B.E. Journal of Economic Analysis & Policy*, *5*(1), 000010151515380645157 4. https://doi.org/10.1515/1538-0645.1574

Auboin, M., Smythe, H., & Teh, R. (2016). *Supply Chain Finance and SMEs: Evidence from International Factoring Data* (SSRN Scholarly Paper 2845280). https://doi.org/10.2139/ssrn.2845280

Baldwin, R., & Lopez- Gonzalez, J. (2015). Supply- chain trade: A portrait of global patterns and several testable hypotheses. *The World Economy*, *38*(11), 1682–1721.

Beyer, H.-M., & Herzog, B. (2021). Supply Chain Finance: Cost–Benefit Differentials under Reverse Factoring with Extended Payment Terms. *International Journal of Financial Studies*, *9*(4), Article 4. https://doi.org/10.3390/ijfs9040059

Biçer, I. (2023). Supply Chain Finance. In I. Biçer, *Supply Chain Analytics* (pp. 257–279). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-30347-0_8

Bilgin, R., & Dinc, Y. (2019). Factoring as a determinant of capital structure for large firms: Theoretical and empirical analysis. *Borsa Istanbul Review*, *19*(3), 273–281. https://doi.org/10.1016/j.bir.2019.05.001

Bilir, L. K., Chor, D., & Manova, K. (2019). Host-country financial development and multinational activity. *European Economic Review, 115*, 192–220. https://doi.org/10.1016/j.euroecorev.2019.02.008

Blanchard, E. J., Bown, C. P., & Johnson, R. C. (2016). *Global Supply Chains and Trade Policy* (Working Paper 21883). National Bureau of Economic Research. https://doi.org/10.3386/w21883

Boehm, J. (2022). The Impact of Contract Enforcement Costs on Value Chains and Aggregate Productivity. *The Review of Economics and Statistics*, *104*(1), 34–50. https://doi.org/10.1162/rest_a_00940

Bradic-Martinovic, A., Nedović, N., & Balaban, M. (2021). *FACTORING AS A FORM OF FINANCING SMALL AND MEDIUM-SIZED ENTERPRISES IN SERBIA*.

Budin, M., & Eapen, A. T. (1970). Cash Generation in Business Operations: Some Simulation Models. *The Journal of Finance*, *25*(5), 1091–1107. https://doi.org/10.2307/2325581

Chen, F. (2022). Corporate Financing Mode (1)—Financing Factoring. In F. Chen, *Essential Knowledge and Legal Practices for Establishing and Operating Companies in China* (pp. 461–463). Springer Nature Singapore. https://doi.org/10.1007/978-981-19-2239-8_88

Chen, X., Liu, C., & Li, S. (2019). The role of supply chain finance in improving the competitive advantage of online retailing enterprises. *Electronic Commerce Research and Applications*, *33*, 100821. https://doi.org/10.1016/j.elerap.2018.100821

Choi, S., Furceri, D., Huang, Y., & Loungani, P. (2018). Aggregate uncertainty and sectoral productivity growth: The role of credit constraints. *Journal of International Money and Finance*, *88*, 314–330. https://doi.org/10.1016/j.jimonfin.2017.07.016

Chor, D., & Manova, K. (2012). Off the cliff and back? Credit conditions and international trade during the global financial crisis. *Journal of International Economics*, *87*(1), 117–133.

Ci, X., Tian, B., & Yu, J. (2023). *Can Supply Chain Finance Improve Total Factor Productivity Of Enterprises?—Based on Data of A-Share Listed Companies*. https://doi.org/10.2139/ssrn.4648961

De Melo, J., & Twum, A. (2021). Prospects and Challenges for Supply Chain Trade under the Africa Continental Free Trade Area. *Journal of African Trade*, *8*(2 (Special Issue)), 49. https://doi.org/10.2991/jat.k.210105.001

Doan, N. T. (2023). Cultural proximity and global value chains. *International Economics*, *175*, 106–120. https://doi.org/10.1016/j.inteco.2023.06.003

Egger, P. H., & Tarlea, F. (2015). Multi-way clustering estimation of standard errors in gravity models. *Economics Letters*, *134*, 144–147.

Fisman, R., & Love, I. (2003). Trade Credit, Financial Intermediary Development, and Industry Growth. *The Journal of Finance*, *58*(1), 353–374.

Flores-Ureba, S., Plaza-Casado, P., Sánchez-de Lara, M. Á., & Gómez-Ortega, A. (2023). Factoring, Leasing and Confirming for Entrepreneurs. In P. Sendra-Pons, D. Garzon, & M.-Á. Revilla-Camacho (Eds.), *New Frontiers in Entrepreneurial Fundraising* (pp. 39–53). Springer International Publishing. https://doi.org/10.1007/978-3-031-33994-3_4

Foley, C. F., & Manova, K. (2015). International Trade, Multinational Activity, and Corporate Finance. *Annual Review of Economics*, *7*(Volume 7, 2015), 119–146. https://doi.org/10.1146/annurev-economics-080614-115453

Grüter, R., & Wuttke, D. A. (2017). Option matters: Valuing reverse factoring. *International Journal of Production Research*, *55*(22), 6608–6623. https://doi.org/10.1080/00207543.2017.1330564

Gu, L., & Liang, G. (2022). The Effect of Bank Financing under Supply Chain-to-Chain Competition. *Mathematical Problems in Engineering*, *2022*(1), 8575338. https://doi.org/10.1155/2022/8575338

Han, K.-M., Park, S.-W., & Lee, S. (2020). Anti-Fraud in International Supply Chain Finance: Focusing on Moneual Case. *Journal of Korea Trade*, *24*(1), 59–81. https://doi.org/10.35611/jkt.2020.24.1.59

Huang, Y., Pagano, M., & Panizza, U. (2020). Local Crowding-Out in China. *The Journal of Finance*, *75*(6), 2855–2898. https://doi.org/10.1111/jofi.12966

Hummels, D., Ishii, J., & Yi, K.-M. (2001). The nature and growth of vertical specialization in world trade. *Journal of International Economics*, *51*(4), 75–96. https://doi.org/10.1016/S0022-1996(00)00093-3

Jinjarak, Y. (2015). Supply Chains, Global Financial Shocks and Firm Behaviour towards Liquidity Needs. *The World Economy*, *38*(3), 425–444. https://doi.org/10.1111/twec.12202

Johnson, R. C., & Noguera, G. (2012). Accounting for intermediates: Production sharing and trade in value added. *Journal of International Economics*, *86*(2), 224–236.

Khalid, A. M., Sharma, S., & Dubey, A. K. (2020). Data Gap Analysis, Indicator Selection and Index Development: A Case for Developing Economies. *Social Indicators Research*, *148*(3), 893–960. https://doi.org/10.1007/s11205-019-02225-6

Klapper, L. (2006). The role of factoring for financing small and medium enterprises. *Journal of Banking & Finance*, *30*(11), 3111–3130. https://doi.org/10.1016/j.jbankfin.2006.05.001

Koopman, R., Powers, W., Wang, Z., & Wei, S.-J. (2010). *Give credit where credit is due: Tracing value added in global production chains*. National Bureau of Economic Research.

Kroszner, R. S., Laeven, L., & Klingebiel, D. (2007). Banking crises, financial dependence, and growth. *Journal of Financial Economics*, *84*(1), 187–228. https://doi.org/10.1016/j.jfineco.2006.05.001

Lehmacher, W. (2017). Trade and the Global Supply Chain. In W. Lehmacher, *The Global Supply Chain* (pp. 1–38). Springer International Publishing. https://doi.org/10.1007/978-3-319-51115-3_1

Lekkakos, S. D., & Serrano, A. (2016). Supply chain finance for small and medium sized enterprises: The case of reverse factoring. *International Journal of Physical Distribution & Logistics Management*, *46*(4). https://doi.org/10.1108/IJPDLM-07-2014-0165

Levine, R., Lin, C., & Xie, W. (2018). Corporate Resilience to Banking Crises: The Roles of Trust and Trade Credit. *Journal of Financial and Quantitative Analysis*, *53*(4), 1441–1477. https://doi.org/10.1017/S0022109018000224

Li, J., Zhu, S., Zhang, W., & Yu, L. (2020). Blockchain-driven supply chain finance solution for small and medium enterprises. *Frontiers of Engineering Management*, *7*(4), 500–511. https://doi.org/10.1007/s42524-020-0124-2

Liu, B., Wang, Y., & Shou, Y. (2020). Trade credit in emerging economies: An interorganizational power perspective. *Industrial Management & Data Systems*, *120*(4), 768–783. https://doi.org/10.1108/IMDS-05-2019-0292

Manova, K. (2013). Credit Constraints, Heterogeneous Firms, and International Trade. *The Review of Economic Studies*, *80*(2), 711–744. https://doi.org/10.1093/restud/rds036

Manova, K., Wei, S.-J., & Zhang, Z. (2015). Firm Exports and Multinational Activity Under Credit Constraints. *The Review of Economics and Statistics*, *97*(3), 574–588. https://doi.org/10.1162/REST_a_00480

Mina, W. (2006). Does contract enforcement matter for international lending? *Applied Economics Letters*, *13*(6), 359–364. https://doi.org/10.1080/13504850500394350

Minetti, R., Mulabdic, A., Ruta, M., & Zhu, S. C. (2021). Financial structures, banking regulations, and export dynamics. *Journal of Banking & Finance*, *124*, 106056. https://doi.org/10.1016/j.jbankfin.2021.106056

Mol-Gómez-Vázquez, A., Hernández-Cánovas, G., & Koëter-Kant, J. (2018). Legal and Institutional Determinants of Factoring in SMEs: Empirical Analysis across 25 European Countries. *Journal of Small Business Management*, *56*(2), 312–329. https://doi.org/10.1111/jsbm.12260

Mwakujonga, J. (2015). The Influence of Creditor Rights and Contract Enforcement on the Levels of Factor Financing. *International Journal of Financial Economics*, *4*(2), 85–91.

Popov, L. (2014). Enforcement frictions and optimal lending contracts. *Economic Theory*, *57*(1), 195–222. https://doi.org/10.1007/s00199-014-0803-5

Raddatz, C. (2006). Liquidity needs and vulnerability to financial underdevelopment. *Journal of Financial Economics*, *80*(3), 677–722.

Rajan, R. G., & Zingales, L. (1998). Financial Dependence and Growth. *The American Economic Review*, *88*(3), 559–586.

Riad, N., Errico, M. L., Henn, C., Saborowski, C., Saito, M., & Turunen, M. J. (2012). *Changing Patterns of Global Trade*. International Monetary Fund.

Santistevan, D. (2022). Boundary-spanning coordination: Insights into lateral collaboration and lateral alignment in multinational enterprises. *Journal of World Business*, *57*(3), 101291. https://doi.org/10.1016/j.jwb.2021.101291

Shingal, A., Ehrich, M., & Foletti, L. (2021). Re- estimating the effect of heterogeneous standards on trade: Endogeneity matters. *The World Economy*, *44*(3), 756–787. https://doi.org/10.1111/twec.13015

Silva, J. S., & Tenreyro, S. (2006). The log of gravity. *The Review of Economics and Statistics*, *88*(4), 641–658.

Soufani, K. (2002). On the determinants of factoring as a financing choice: Evidence from the UK. *Journal of Economics and Business*, *54*(2), 239–252. https://doi.org/10.1016/S0148-6195(01)00064-9

Stemmler, L. (2002). The Role of Finance in Supply Chain Management. In S. Seuring & M. Goldbach (Eds.), *Cost Management in Supply Chains* (pp. 165–176). Physica-Verlag HD. https://doi.org/10.1007/978-3-662-11377-6_10

Tchamy, J., Peihua, F., Osabutey, W., & Yoboue, W. (2018). Supply Chain Finance Analysis. *International Journal of Academic Research in Business and Social Sciences*, *8*(12), Pages 385-395. https://doi.org/10.6007/IJARBSS/v8-i12/5040

Tian, C., Chen, D., Chen, Z., & Zhang, D. (2020). Why and How Does a Supplier Choose Factoring Finance? *Mathematical Problems in Engineering*, *2020*(1), 9258646. https://doi.org/10.1155/2020/9258646

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. https://doi.org/10.1016/j.ejor.2014.10.052

Wang, Y., Shen, J., Pan, J., & Chen, T. (2022). A Credit Risk Contagion Intensity Model of Supply Chain Enterprises under Different Credit Modes. *Sustainability*, *14*(20), Article 20. https://doi.org/10.3390/su142013518

Wang, Z., Wang, Q., Lai, Y., & Liang, C. (2020). Drivers and outcomes of supply chain finance adoption: An empirical investigation in China. *International Journal of Production Economics*, *220*, 107453. https://doi.org/10.1016/j.ijpe.2019.07.026

Wignaraja, G. (2015). Factors Affecting Entry into Supply Chain Trade: An Analysis of Firms in Southeast Asia. *Asia & the Pacific Policy Studies*, *2*(3), 623–642. https://doi.org/10.1002/app5.78

Wuttke, D. A., Blome, C., Sebastian Heese, H., & Protopappa-Sieke, M. (2016). Supply chain finance: Optimal introduction and adoption decisions. *International Journal of Production Economics*, *178*, 72–81. https://doi.org/10.1016/j.ijpe.2016.05.003

Xu, X., Chen, X., Jia, F., Brown, S., Gong, Y., & Xu, Y. (2018). Supply chain finance: A systematic literature review and bibliometric analysis. *International Journal of Production Economics*, *204*, 160–173. https://doi.org/10.1016/j.ijpe.2018.08.003

Zeng, S., Luo, C., & Zhao, L. (2023). Destination trade credit and exports: Evidence from cross-country panel data. *Journal of International Money and Finance, 137*, 102900.

Zhu, L., & Ou, Y. (2023). Enhance financing for small- and medium-sized suppliers with reverse factoring: A game theoretical analysis. *Annals of Operations Research*, *331*(1), 159–187. https://doi.org/10.1007/s10479-021-04361-0

Appendix

Table A1: Variable Description

Variable	Description	Source
SCT	Importing partner share of domestic value added (DVA) in gross exports	OECD TiVA 2023
SCF	Total factoring volume to GDP (%)	Factors Chain International
EFD	The percentage of total assets financed by trade credit	Foley and Manova, (2015); Minetti et al., (2021)
comrelig	The dummy taking a value of 1 if there is a common religion between two countries.	CEPII
contig	The dummy taking a value of 1 if there is a contiguity between two countries.	CEPII
comlang_off	The dummy taking a value of 1 if they have the same official language.	CEPII
comcol	The dummy taking a value of 1 if a country is a common colonizer post 1945.	CEPII
rta	The dummy taking a value of 1 if a country has a regional trade agreement.	CEPII
D	Log value of the distance between country *i* and *j*, and 0 otherwise.	CEPII
Polity	A value of 1 for these countries above the median of Polity IV score and 0 for others.	Polity IV Project
InvestmentP	A value of 1 for these countries above Investment Profile and 0 for others	ICRG
Uncertainty	A value of 1 for these countries above WUI and 0 for others	EUI
Crisis	takes a value of 1 if country i experienced a banking, debt, or currency crises	Global Crisis Data

Note: CEPII: The Centre d'Etudes Prospectives et d'Informations Internationales;

ICRG: International Country Risk Guide

OECD Trade in Value Added (TiVA) database 2021.

EIU: Economist Intelligence Unit.

Table A2: List of countries

No.	Reporter	Percent	No.	Reporter	Percent	No.	Reporter	Percent
1	ARG	1.38	26	FRA	1.38	51	NGA	1.38
2	AUS	1.37	27	GBR	1.38	52	NLD	1.37
3	AUT	1.38	28	GRC	1.38	53	NOR	1.38
4	BEL	1.37	29	HKG	1.37	54	NZL	1.38
5	BGD	1.38	30	HRV	1.38	55	PAK	0.71
6	BGR	1.38	31	HUN	1.38	56	PER	1.38
7	BLR	1.37	32	IDN	0.7	57	PHL	1.38
8	BRA	1.38	33	IND	1.38	58	POL	1.38
9	BRN	1.38	34	IRL	1.37	59	PRT	1.38
10	CAN	1.38	35	ISL	1.38	60	ROU	1.37
11	CHE	1.38	36	ISR	1.38	61	RUS	1.39
12	CHL	1.38	37	ITA	1.38	62	SAU	1.38
13	CHN	1.38	38	JOR	1.37	63	SEN	1.38
14	CIV	1.38	39	JPN	1.37	64	SGP	1.38
15	CMR	1.39	40	KAZ	1.37	65	SVK	1.38
16	COL	1.38	41	KHM	1.37	66	SVN	1.38
17	CRI	1.38	42	KOR	1.38	67	SWE	1.38
18	CYP	1.38	43	LAO	1.38	68	THA	1.38
19	CZE	1.38	44	LUX	1.39	69	TUN	1.38
20	DEU	0.73	45	LVA	1.38	70	TUR	1.38
21	DNK	1.37	46	MAR	1.38	71	TWN	1.38
22	EGY	1.38	47	MEX	1.38	72	UKR	1.38
23	ESP	1.38	48	MLT	1.38	73	USA	1.37
24	EST	1.37	49	MMR	1.38	74	VNM	0.68
25	FIN	1.38	50	MYS	0.69	75	ZAF	1.37

Table A3: Correlation matrix

	SCFxEFD	*SCF*	*D*	*comlang_off*	*comcol*	*comrelig*	*contig*	*rta*
SCFxEFD	1							
D	-0.0566***	-0.0845***	1					
comlang_off	0.00381***	0.00563***	0.000347	1				
comcol	-0.0172***	-0.0256***	-0.0537***	0.183***	1			
comrelig	0.0386***	0.0576***	-0.167***	0.123***	-0.0248***	1		
contig	0.00343***	0.00512***	-0.338***	0.107***	0.0666***	0.109***	1	
rta	0.165***	0.246***	-0.462***	0.0172***	-0.0439***	0.177***	0.154***	1

Table A4: IV estimation results: First stage

VARIABLES	(1) *SCFxEFD*	(2) *SCFxEFD*
ECCostxEFD	0.00***	
	(0.000)	
ECScorecostxEFD		0.00***
		(0.000)
	(0.000)	(0.000)
Constant	0.01***	-0.00***
	(0.000)	(0.000)
GRA variables	YES	YES
Observations	1,165,703	1,165,703
R-squared	0.091	0.243
FE	NO	NO

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
A set of GRA variables is included.