CAPITAL UNIVERSITY OF SCIENCE AND TECHNOLOGY, ISLAMABAD

Impact of Dynamic Supply Chain Finance Solutions on Performance of Financial Service Providers

by

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A dissertation submitted in partial fulfillment for the degree of Doctor of Philosophy

in the

Faculty of Management & Social Sciences
Department of Management Sciences

2024

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2024

To Allah Almighty (SWT) Who has been there right from the beginning to this point.

To my beloved father, the late Munir Ahmad, and my cherished mother, the late Anisa Munir, whose love and wisdom continue to inspire me every day. Your memories are my strength and motivation.

To my precious daughter, Hania-Tul-Muntaha, your innocent smile and boundless love are my greatest joys. You are the light of my life, and everything I do is for you.

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CERTIFICATE OF APPROVAL

This is to certify that the research work presented in the dissertation, entitled "**Impact of Dynamic Supply Chain Finance Solutions on Performance of Financial Service Providers**" was conducted under the supervision of **Dr. Nousheen Tariq Bhutta**. No part of this dissertation has been submitted anywhere else for any other degree. This dissertation is submitted to the **Department of Management Sciences, Capital University of Science and Technology** in partial fulfillment of the requirements for the degree of Doctor in Philosophy in the field of **Management Sciences.** The open defence of the dissertation was conducted on **September 13, 2024**.

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I, **Munibah Munir** (Registration No. **DMS201001**), hereby state that my dissertation titled, "**Impact of Dynamic Supply Chain Finance Solutions on Performance of Financial Service Providers**" is my own work and has not been submitted previously by me for taking any degree from Capital University of Science and Technology, Islamabad or anywhere else in the country/ world.

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I solemnly declare that research work presented in the dissertation titled "**Impact of Dynamic Supply Chain Finance Solutions on Performance of Financial Service Providers**" is solely my research work with no significant contribution from any other person. Small contribution/ help wherever taken has been duly acknowledged and that complete dissertation has been written by me.

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List of Publications

It is certified that following publication(s) has been accepted out of the research work that has been carried out for this dissertation:-

1. Munir, M. & Buttha. N, (2023). Light in the Tunnel or Just a train; Impact of Supply Chain Finance Solutions on Financial Service Providers' Financial Performance by Mitigating Financial Risk.". *PLOS ONE* https://doi.org/10.1371/journal.pone.0292497.

2. Munir, M., Khan, A., & Bhutta, N. T. (2024). A Comparative Study between Growth of offering supply chain finance with Non-offering Banks in Pakistan. *The Asian Bulletin of Big Data Management*, 4(1), 132-139.

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Acknowledgements

All the praises to Allah Almighty, the most beneficent, merciful, and creator of all universes, who enabled me to complete this task. This all is because of His countless blessings that, despite having a lot of obstacles, I remained strong enough to deal with them positively. This is all because of Almighty, who provided me with the support of all those people who guided me and helped me from the beginning to the end in achieving this milestone.

Secondly, I am grateful to my supervisor, **Dr. Nousheen Tariq Bhutta**, for her guidance and support. Her expertise and encouragement have been invaluable throughout this journey.

I also extend my heartfelt thanks to my friends and colleagues who offered their unwavering support and assistance whenever needed. Their constructive feedback and moral support played a crucial role in the successful completion of this work.

Lastly, my greatest appreciation goes to my brothers and family for their support, patience, and prayers. Their constant encouragement and love have been my pillars of strength, and I am truly blessed to have them by my side.

Abstract

The study aimed to empirically examine the impact of supply chain finance solutions on financial service providers financial performance, considering the mediating effect of financial risk and the moderating role of financial visibility and firm growth. By breaking new ground and addressing the gap area in the literature, this study pioneer to create a Supply Chain Finance Solution Index to measure its impact on financial service providers' financial performance. The sample comprises the Asian Development Bank-registered countries bank under the supply chain finance program. The sample of this study consists of 35 banks across of 8 countries 2012 to 2022. Based on theoretical background support align with bargaining power theory, information processing theory and signaling theory a research model is developed to conduct an empirical study in the context of supply chain finance. The study used fixed effect model and robustness test System GMM (Generalized Method of Moments) for the panel data structure to test the hypothesis of the study.

The results of the study contribute to the knowledge of literature on how supply chain finance solutions impact financial service providers financial performance and mediating role of financial risk. This study also fills a gap by investigating the moderating role of financial visibility in the relationship between supply chain finance solutions and financial service providers financial performance. Furthermore, literature extended with the moderating role of firm growth in the relationship between supply chain finance solutions and financial service providers financial performance. The results indicate that supply chain finance solutions have significant positive impacts financial service providers financial performance.

The study results show that financial risk mediated the relationship between supply chain finance solutions and financial service providers financial performance. Moreover, the moderating role of financial visibility enhances the relationship between supply chain finance solutions and financial service providers financial performance. Firm growth also influences as moderator in the relationship between supply chain finance solutions and financial service providers financial performance. To sum up,

this study provides guidelines for banks on how supply chain finance program can improve their growth, mitigate risk and enhance overall firm performance.

Moreover, Policy makers use these results to formulate the supply chain finance strategies to optimize the financial performance of financial service providers through such targeted financing programs. The findings emphasize practical implications, suggesting guidelines for investors. Financial visibility prioritization strategy uses as wealth maximization through enhanced financial service provider financial performance. It advocates for banks to sustain these financing initiatives to bolster overall firm performance, especially in regions where traditional trade credit is challenging and bank risk levels are elevated. The study is also beneficial for academic researchers seeking knowledge in the area of supply chain finance. This study opens the door for further literature contributions, questioning whether supply chain finance is a light in the tunnel or just a passing train.

Keywords: Supply Chain Finance, Financial Service Providers Financial Performance, Financial Riks, Financial Visibility, Firm Growth, Supply Chain Finance Solutions Index.

Contents

List of Figures

List of Tables

Abbreviations

ABD	Asian Development Bank
FSP	Financial Service Provider
FEM	Fixed Effect Model
GMM	Generalized Method of Moments
GDP	Gross Domestic Product
OLS	Ordinary Least Square
SCF	Supply Chain Finance

Chapter 1

Introduction

1.1 Study Background

Over the last two decades, many emerging and innovative finance practices have captured the attention of researchers. Supply chain finance is also a new financial practice garnering attention from suppliers, buyers, and particularly significant contributors in the supply chain, such as financial providers like banks. Since its inception, academics and practitioners have been researching and identifying various ways to manage and improve supply chain finance for all involved parties like buyer, suppliers and finance providers. In this context, financial providers like banks also working on to transform the traditional banking system to innovational financing solutions (Gomber et al., 2017).

Since the 2008 financial crisis, firms have been facing cash-flow constraints and under high liquidity pressures for corporate borrowing and bank financing (Ashourizadeh and Zhang, 2021; Berger et al., 2020; Lee et al., 2000). In the financial sector, the crises facing countries reignite the financial role. Under this umbrella, in 2009, the Asian Development Bank introduced a trade and supply chain finance program to empower countries with sustainable goals development to fill the solution gaps of loans, guarantees, and product knowledge.

The Purpose of the Asian Development Bank's supply chain finance program is to benefit all the registered countries' banks with improved and modified trade finance solutions. Transform the traditional trade finance to a risk mitigation technique

solution. This program can be a valuable support for banks in emerging markets trade finance. In traditional financing methods, banks mainly focus on overall financial performance and aim to optimize overall financial health and profitability.

Conversely, supply chain finance primarily seeks to optimize the payment terms between suppliers and buyers, enhancing cash flow and working capital. Banks play a vital role in facilitating early payment to suppliers by providing supply chain finance solutions to buyers (Cavenaghi, 2014). In Supply chain finance, banks use different solutions like factoring, dynamic discounting, and invoice discounting. In traditional trade finance, banks offer overall guarantees and various financial instruments such, as letter of credit, for smooth international transactions to mitigate cross-border trade (Wang and Xu, 2023). Supply chain finance mainly focuses on lowering the credit risk as it relies most of the time on the buyers' creditworthiness.

1.2 The Asian Development Bank Supply Chain Finance Program

The Asian Development Bank (ADB) was established in 1960s as a financial institution to foster the economic growth along with cooperation for the developing countries in world poorest regions. In 2009 ADB started its supply chain finance program with the aim to reduce the financing gap between SMEs and banks and help them to become part of global trade. All the registered countries with Asian development bank (Pakistan, Bangladesh, China, Armenia, Georgia, Mongolia, Nepal, Sri Lanka, Tajikistan, and Uzbekistan) supply chain finance program effort to get growth. These countries broaden private sector to support SCF, enable growth with improve cash flow. Traditional companies were getting finance from banks on the base trade finance, but new supply chain finance solutions allowing the all parties of supply chain finance to mitigate their financial risk and enhance performance. From all the ADB and registered countries banks with SCF program working on to reduce the global trade finance gap and solve the unmet demand for longer-time period. The risk sharing agreement between them enable them increase their financing capacity.

1.3 Supply Chain Finance

In todays emerging trends, supply chain finance is a very a common word in the modern banking financing system. It consists of two words: supply chain connection of material flow with information flow, and finance means money or monetary resource. The supply chain finance concept is related to money/financial flow from financial service providers to suppliers and buyers (Atkinson, 2008).

Hofmann (2011a) explained supply chain finance is a method for an organization in the finance and service provider to create resource planning, information and controlling joint value at inter-organizational-level. Supply chain finance is use to help working capital management by using mostly reverse factoring, which is buyer-centric rather than supplier (Seifert and Seifert, 2009).

Later on, a more precise definition of supply chain finance was described by Pfohl and Gomm (2009); it is an intern-company finance optimization and financing processes integration with suppliers, customers and financial service providers and increases the value of all supply chain finance participants. There are difference sections in supply chain finance; these different sections are divided further: the first section is actors (primary and supportive members), the second section is objects (assets and operating working capital) and the third section is levers (time, volume and capital cost rate).

First, identify the supply chain actors, who work together in SCF. A per the above figure 1, the supply chain finance framework shows, actors are divided into two sections primary and supportive. The financial agreement between supply chain finance program required at least two primary members to set up an order. A direct supplier can benefit from supportive actors financial service providers based on focal company creditworthiness at cheaper financing (Davydov et al., 2017a).

Next, section of the framework is objects, and it is used to get financing solution (Pfohl and Gomm, 2009). The third section, is supply chain finance levers framework of time, volume and capital cost rate. In lever section, volume is companys total number of invoices to get finance for time period thats need to be get finance at the total cost of finance for a specific object. Duration of levers supply chain finance is the financing time period and objective represent the total financing cost.

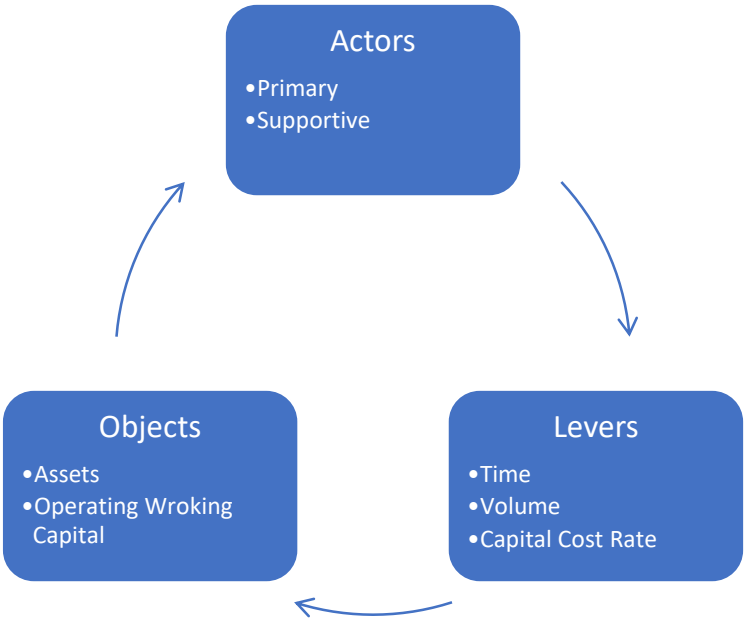

FIGURE 1.1: Supply Chain Finance Framework

In the supply chain, suppliers and buyers have competing financial interests. Suppliers want to get paid as early as possible and buyers want to pay as late as possible. Supply chain finance has linked these interests as a bridge. This competing financial interest provides a range of financing with risk mitigation solutions by financial service providers, specifically banks. With the help of following picture 1.2, this relationship gives clearer picture about the buyer, supplier and banks relationship. If banks provided funds on the request of suppliers, that is supplier-oriented solution on the other side if the banks provide on the request of buyer that is buyer-oriented solution.

1.4 History of Supply Chain Finance

In recent research, supply chain finance is a new concept compared to traditional financing method (Shen et al., 2019). Supply chain finance has an early 70s root history; in the early 1970s, the concept was introduced from the standpoint of inventory and trade credit. Budin and Eapen (1970) explained, the net cash flow activities affect the cash planning phase in the organization. Furthermore, the study explained that trade credit and inventory financing impact net inflows. In

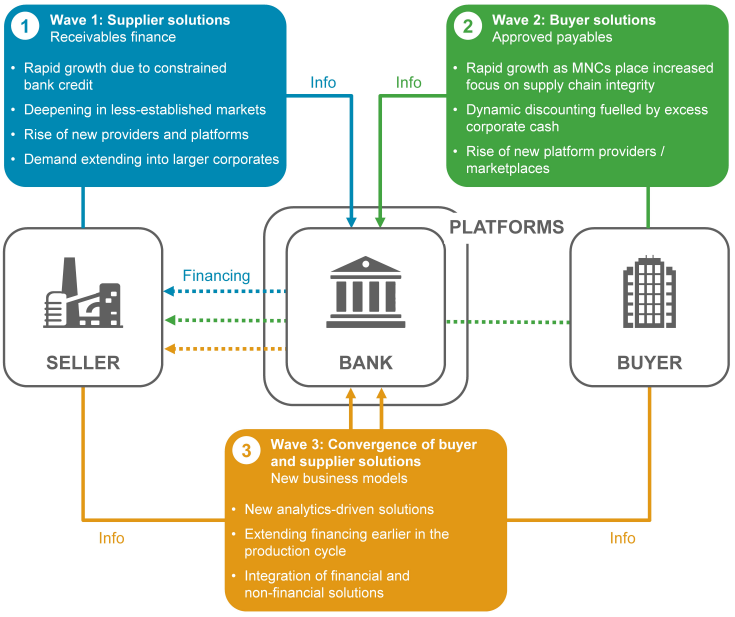

FIGURE 1.2: Supply Chain Finance Waves

most recent times, these two trade credits and inventory have been used as supply chain finance solutions.

Supply chain finance early stage is primarily based on the single company economic characteristics (Wood, 1981). Until early 2000s the idea of supply chain finance was not fully established. In the early 2000s, the key aspect of supply chain finance is financial flows integration with physical supply chain, which was considered a critical component of supply chain management (Stemmler, 2002). Later on, Hofmann (2005), explained that logistics, SCM, and SCF divide the supply chain players internally and externally.

After the 2008 financial crisis, worldwide lending changed from financial institutions. Growth of supply chain finance was also affected after the crises; financial institutions faced risk due to not properly measuring risk. In 2008, 13% of organizations claimed that SC disruptions occurred due the suppliers financial failure (Sadlovska, 2007).

All these supply chain finance disruptions and risks increased the supply chain finance demand for different solutions and supply chain finance programs to mitigate the financial risk and growth of financial service providers (Gong et al., 2022).

Financial service providers in the SC from the start to mitigate the funding difficulties.

SCF most common definitions are summarized after the 2008 financial crisis with the inclusion of financial service providers' point of view. (Pfohl and Gomm, 2009), it is inter-company finance optimization as well financing processes integration with suppliers, customers and financial service provider and increases the value of all supply chain finance participants.

After the 2008 financial crisis there is another major upset which shake the financial structure is COVID-19 pandemic created a new financial disruption to supply chain finance and gave scope for risk mitigation solutions, growth and overall financial performance of the financial service providers (Moretto and Caniato, 2021). It also showed the importance of combining different solutions to mitigate the financial pressure.

1.5 Theoretical Background

Although theoretical support to supply chain finance is important, as underscored Gelsomino et al. (2016), SCF proper theory mechanism remains scant to date. To the best of my knowledge, this study used the following three underpinning theories related to supply chain finance, financial risk, financial visibility, growth and firm performance: bargaining power, information processing theories and signaling theory.

1.5.1 Bargaining Power Theory

In bargaining power theory, all parties are in an argumentative situation, such as contract writing, making agreements, or barraging contracts, where one party has more influence over the other. Kuhn et al. (1983), bargaining power is the ability of different parties to use power over each other when they bargain. In supply chain finance, bargaining is called if one party has strong power and exercises power to gain more over the weaker party (Crook and Combs, 2007).

The financial service provider may not be able to determine how much risk they are taking through offering a supply chain, but as a risk taker, they have more power to exercise bargaining power, and it will affect their financial performance. So, they will exercise more gain over transactions due to taking risk (Cho et al., 2019). Banks with strong bargaining power towards other parties suggested that as risk-taker they are more in the situation to extract influence over others to get off set against risk (Fabbri and Klapper, 2016). Week bargaining power of the parties forced them to bear high risk and costs by taking finance (Munson et al., 1999).

As banks are offering different supply chain finance solutions which gave them more power to grab the market and growth in the market. Therefore, the underpinning theory of the study is to minimize financial risk and increase firm performance through supply chain finance, and linked it with bargaining power theory of financial service providers. The theory helped in the study to establish a link between supply chain finance and financial service provider financial performance through financial risk.

1.5.2 Information Processing Theory

The second underpinning theory is the information processing theory. Information processing theory is that decision-makers need information according to the level of risk and financial visibility (Galbraith, 1974).

In supply chain finance, information about debt, transaction cost and liabilities management (Gomm, 2010), also external information about market technology, politics and environment. Financial service providers are always working on wealth maximization and want to grow in the market. They require more visible information to decrease any financial solution's risks and overall cost (Gomm, 2010; Pfohl and Gomm, 2009).

Greater risk level and visibility are required to achieve the desired financial performance (Graupner et al., 2015). The main objective of supply chain finance is to bring the financial, product and information flow into line. Information flow is one of the key points in a bank's performance and is used to reduce uncertainty when banks offer supply chain finance solutions. Such related information includes

transaction costs between parties, interest rate, receivable management (Gomm, 2010), market information, policies and complete financial visibility. By using such information, banks can use to decrease financial risk levels with increased financial visibility.

Therefore, the second underpinning theory of the study to enhance financial visibility and firm performance through supply chain finance solutions is linked with information processing theory for financial service provider. With the help of this theory study, a link is generated between supply chain finance and financial service provider financial performance, which has an iinfluencing role of financial visibility as a moderator. The theory furthermore elaborates that a finance provider with more financial visibility significantly impacts firm performance.

1.5.3 Signaling Theory

Signaling theory explains when there is asymmetry information between two parties (finance provider and supplier/buyer), then how one-party work on to minimize asymmetry information (Bhattacharya, 1979; Miller and Rock, 1985). Therefore, the finance providers improve the firm growth by signaling to mitigate asymmetry information (financial risk) and increase firm performance. Brigham et al. Brigham and Houston (2006), explained that signal theory provides an investor with information regarding firm performance and growth direction based on financial service provider behavior.

Furthermore, this information signal is about the company's potential for growth and enhanced firm performance. This theory also addresses situations where one side has more information than the other. For investors firm growth is very important for future investment decisions, which affect the firm performance (Kim et al., 2009).

Moreover, Spence Spence (1973) & Spence (2002), explained that higher growth data offers more authentic information about the underlying performance. It is also anticipated that companies with a good performance have more incentives for higher growth, which shows the true picture of the firm and prevents adverse selection.

Thus, signaling theory explains that finance provider improves the firm growth with the help of disseminating market signal for asymmetric information mitigation, which will also reduce investor risk and improve firm performance. This discussion shows that firm growth moderates the relationship between supply chain finance and financial service provider financial performance. Therefore, this theory helps establish a moderating link between firm growth and performance.

1.6 Research Gap

After reviewing past literature and theories, the following research gap has been identified.

The past literature indicates the supply chain finance significantly affect the service provider's performance (Lam et al., 2019). Different studies show the initiating of supply chain finance contributes positively towards the financial provider financial performance. In literature the more focus is on finance take not providers like banks. The study of supply chain finance is limited and only focus on SCF actors (buyers and suppliers) with primary data (Ali et al., 2020). Moreover, specifically after initiating he supply chain finance program from ABD registered countries side is not studied.

However, the study of supply chain finance solutions' impact on financial service providers financial performance is limited. So, finance providers like banks or financial institutions financial performance with supply chain finance solutions are required to be studied and its impact on the performance especially financial side of banks.

Therefore, firstly, the study has provided empirical evidence of a relationship between supply chain finance and financial service provider financial performance with Longitudinal data and fill the research gap on the relationship of supply chain finance and finance provider performance with secondary day. Therefore, firstly, the study has provided empirical evidence of a relationship between supply chain finance and financial service provider financial performance with Longitudinal data.

Supply chain finance solutions are considered risk mitigation strategies, Lam and Zhan (2021) studied the impact of supply chain on firms risk and concluded that

supply chain finance and firm risk has significant relationship, SCF contribute to mitigate firm risk. Any banks or financial institution who start finance to supply chain finance parties want to make sure their own risk-level not increase which can affect his performance. To mitigate this fact, supply chain finance program main objective is to mitigate the risk between parties along the finance providers. Financial service providers provide the finance against non-paid invoices as an advance payment and take risk. By taking this risk their performance specifically financial outcome has create significant difference.

Therefore, theoretical and empirically investigating of the mediating role of financial risk in the relationship between supply chain finance solutions and financial performance financial service provider is still missing. Although supply chain finance solutions are important as financing instruments for banks to enhance the firm performance, banks take risk by offering SCF solutions, which can lead towards financial risk. This financial risk relationship needs to be investigated as a mediating role between supply chain finance and financial service provider financial performance. So, the studied planned to investigate the relationship of supply chain finance and financial performance financial service provider with meditating role of financial risk.

Therefore, Secondly, the financial risk the mediators affect is interference rather than reinforcement between the relationship of supply chain finance and financial service provider financial performance. To the best of my knowledge, no empirical findings elaborate the relationship betweensupply chain finance and financial performance financial service provider with mediating role of financial risk. Either financial risk mediates this relationship or not. So, the study plans to fill the gap by investigating the supply chain finance solutions impact on firm financial performance through financial risk.

Thirdly, in empirical evidence in literature which shows financial visibility, Li et al. (2019) used efficiency ratio for financial visibility on bank performance. In financial performance financial visibility is very crucial from investor point of view as they want to get secure investment if banks are into new financing solutions this will ultimately affect the bank performance.

However, the study of financial visibility with financial service providers' financial performance when offering supply chain finance solutions is limited. On the other side visibility is studies in literature form supply chain visibility side among the supply chain parties not with the relation with finance providers. But when current study is about the financial risk and financial service provider and supply chain finance as an innovating financing solution there is gap to study the financial visibility side. So, this study planned to contribute to the research gap on how financial visibility moderates the supply chain finance solutions and financial service provider financial performance.

Therefore, there is high financial visibility and investor will get clear and visible information about the banks performance they will invest in that particular bank, a high financial visibility as moderator strength the relationship of supply chain finance solutions with firm financial performance. on the other side low financial visibility weaker the moderating relationship between supply chain fianc solutions and banks financial outcome This research gap is required to be studied as to how supply chain financial solutions with the moderating role of financial visibility on the relationship of banks financial performance.

Banks offer innovative financial techniques and solutions to get growth in the market and financial performance. Lee et al. (2000), studied the relationship between financials innovation and banks growth. The study concluded that financial innovation has a positive impact on bank growth.

Growth is the market signal which further impact the banks performance. In the literature growth is studied and its impact on the banks financial outcomes but lack in literature to study the influencing impact either stringer or weaker on the banks financial outcomes

This study indicates that supply chain finance is a financial innovation offered by the banks to enhance their growth, which ultimately contributes to a firm financial performance. Therefore, significantly high growth strengthens the relationship of supply chain finance with firm financial performance. Moreover, no empirical evidence shows how supply chain finance and financial service providers financial performance influence firm growth. This research gap is required to study how supply chain finance and financial performance influenced by firm growth.

1.7 Problem Statement

Supply chain finance is a financing solution offered with the aim to lower the financing cost and improve firm performance for all participants in the supply chain. In a typical supply chain process suppliers sell products/services and buyers pay invoice. But, most of the time buyers are running out of cash shortage or not ready to pay early or advance invoices. On the other side suppliers will to get payment in advance against their issued invoice. To solve this problem a third participant/ actor (bank) provides finance on the behalf of buyer to supplier that is buyer orientated. If a financial service provider (bank) provide finance on the request of supplier that is supplier-orientated. For both parties financial service provider lower the risk (Pellegrino et al., 2019).

Different studies show that supply chain finance allows the finance provider to maintain a low-risk level by offering different solutions. Banks are risk taker and by taking this risk may affect their financial performance and financial risk level (Ali and Oudat, 2020). Banks are ready to take risk, offer supply chain finance solutions as an innovating financing tool, and want to enhance their financial performance. However, different offered supply chain finance solutions have an impact or not on their financial performance and mitigate financial risk is still not yet fully studied. Therefore, it is necessary to inquire about the Asian development registered countries banks offering different supply chain finance effects on their performance and financial risk-level.

Supply chain finance solutions are offered with the intention of strengthening with significant growth. However, banks offering different supply chain finance solutions may contribute significantly to their growth and financial performance, which is an addressable issue that needs to be addressed. Therefore, it is worthy to study the influence of firm growth in the relationship of supply chain finance and financial service provider financial performance.

Moreover, another issue is that the purpose of Asian development bank registered countries banks is to get more and more benefit from such financial solutions, but if these solutions do not contribute a significant impact on financial performance. So, it is well-intentioned to study the financial visibility moderating role in the

relationship between supply chain finance and financial service provider financial performance.

1.8 Research Question

The Study is planned to answer the following questions:

1. What is the impact of the supply chain finance solutions on the financial service provider's financial performance?

2. How does financial risk mediate the relationship between supply chain finance solutions and financial service providers' financial performance?

3. What is the moderating role of financial visibility on the relationship between supply chain finance solutions and financial service provider's financial performance?

4. What is the moderating role of growth on the relationship between supply chain finance solutions and financial service provider's financial performance?

1.9 Research Objectives

The main objectives of the study are as follows:

1. To study the impact of supply chain finance solutions on the financial service provider's financial performance.

2. To analyze the mediating role of financial risk in the relationship between supply chain finance solutions and financial service providers' financial performance.

3. To analyze the moderating role of financial visibility on the relationship between supply chain finance solutions and financial service provider's financial performance.

4. To analyze the role of the firm growth moderating the relationship between supply chain finance solutions and financial service providers' financial performance.

1.10 Significance of the Study

The significance of the study is classified into three sections: theoretical, contextual, and practical.

1.10.1 Theoretical Significance

First, this study adds to the:

By empirically capturing the mediating relation of financial risk between supply chain finance and firm financial performance, this study contributes to the body of knowledge related to bargaining power theory. This study also contributes to the literature on the relationship of supply chain finance with firm financial performance through financial visibility. This study also provides empirical evidence of the information process theory as a reduction in asymmetric information with financial visibility to offer supply chain finance solutions. As a result, this study explains statistically that offering a supply chain finance solution increases a firm's financial performance and results in significant growth.

1.10.2 Contextual Significance

This study aims to empirically study the impact of supply chain finance solution on firm financial performance, which opens a new window for future research for academic researchers and practitioners. This study also opens doors for researchers to research finance providers and its financial risk. As finance provider in supply chain finance this study highlights the importance of financial risk for financial service provider financial performance.

Asian development program introduces new innovational financing solutions to the registered countries, as in most registered countries are developing and facing many

financial issues. Their financial insatiability also affects the overall economy. So, without adequate financial visibility for financial service providers of supply chain finance is questionable. The study empirically adds the impact of supply chain finance on financial service provider financial performance relationship through financial risk, the moderating role of financial visibility and firm growth in the Asian development bank registered countries.

1.10.3 Practical Significance

The results guide the policy makers on how supply chain finance in the Asian development bank registered countries banks influences financial performance. Findings of the study also suggest the use of this information for effective decision-making and enhancement of the financial performance of finance providers. Moreover, policymakers can use this study's findings as guidelines for firm financial performance. Additionally, investors' main concern is lowering risk-level and increasing wealth, and new innovational supply chain finance opens potential growth opportunities for banks and investors. This study highlighted that more financial visibility would increase firm financial performance and mitigate financial risk.

1.11 Organization of the Study

The study is arranged such that the literature review, research hypotheses development and theoretical framework are covered in second chapter. The third chapter is about thesis methodology, including variables measurement, data source, data type, statistical measurement and application of statistical techniques. Thesis's fourth chapter is on results and discussion. The final fifth chapter concludes the all-thesis work, policy implications, limitations and future directions of the study.

Chapter 2

Literature Review and Theoretical Background

This chapter is about the general background of the conceptual framework and literature review, hypotheses establishment, and the demonstration of the studys conceptual framework.

2.1 Theoretical Background

Although theoretical support for supply chain finance is important but limited Chatterjee and Nag (2023), to date, in literature SCF proper theory mechanism remains study able. This study used the following three underpinning theories related to supply chain finance, financial risk, financial visibility, growth and firm performance: bargaining power, information processing theories and signaling theory.

2.1.1 Bargaining Power Theory

In bargaining power theory, all parties are in an argumentative situation like contract writing, making agreements, or barraging contracts where one party has more influence over the other. Kuhn et al. (1983), bargaining power is the ability of different parties to use power over each other when they bargain. In supply chain

finance, bargaining is called if one party has strong power and exercises power to gain more over the weaker party (Crook and Combs, 2007).

The financial service provider may not determine how much they are taking risk through offering supply chain, but as a more risk taker they have more power to exercise bargaining power and it will affect their financial performance. So, they will exercise more gain over transactions due to taking risk (Cho et al., 2019).

Banks with strong bargaining power towards other parties suggested that as risk-takers they are more in the situation to extract influence over others to get off set against risk (Fabbri and Klapper, 2016). The weak bargaining power of the parties forced them to bear high risk and cost by taking finance (Munson et al., 1999). Banks are offering different supply chain finance solutions which gives them more power to grab the market and show more financial performance.

Therefore, the underpinning theory of the study to minimize finance risk and increase firm performance through supply chain finance is linked with the bargaining power theory for financial service providers. The theory helped in the study to establish a link of supply chain finance and performance with mediating role of financial risk with bargaining power.

2.1.2 Information Processing Theory

The second underpinning theory is the information processing theory. Information processing theory is that decision-makers need information to mitigate risk levels (Galbraith, 1974). In supply chain finance information like debt and transaction cost and liabilities management (Gomm, 2010), also external information about market technology, politics and environment effects the business performance.

Financial service provides always working on wealth maximization and want to grow in the market, for this they require more visible information which helps to improve financial performance and mitigate financial risk (Gomm, 2010; Pfohl and Gomm, 2009). Moreover, Greater the risk-level, greater visibility is required to achieve the desired financial performance (Graupner et al., 2015).

Supply chain finance objective to align all flows (product, information & financial). Information flow is using as important factor for banks performance and is used

to reduce uncertainty when banks offer supply chain finance solutions; such types of related information include transaction costs between parties, interest rate, receivable management Gomm (2010), as well as market information, policies and complete financial visibility. By using such information, banks can use to decrease financial risk levels with increased financial visibility.

Moreover, the second underpinning theory of the study to enhance financial visibility and firm performance through supply chain finance solutions is linked with information processing theory for finance providers. This theory established a link is generated between supply chain finance and financial service provider financial performance by the influence of financial visibility.

The theory furthermore elaborates that financial service providers with more financial visibility have a significant impact on financial performance. Supply chain finance is financing solutions, when this solution is provided, more and more information and visibility is basic part. More the financial visibility of financial service providers impacts financial service providers financial performance.

2.1.3 Signaling Theory

The signaling theory is the firm financing choices when there is asymmetry information between the parties. Signaling theory explains when there is asymmetry information between two parties (finance provider and supplier/buyer), then how one-party works to minimize asymmetry information (Bhattacharya, 1979; Miller and Rock, 1985). Therefore, the finance providers improve the firm growth by signaling to mitigate asymmetry information (financial risk) and increase firm performance. Brigham et al.

Brigham and Houston (2006) explained that signal theory provides investors with information regarding firm performance and growth direction based on financial service provider behavior. So, the information signal is about the company's potential for growth and enhanced firm performance. This theory also addresses situations where one side has more information than the other. Firm growth is important for investors to provide them with sufficient information to make their

future financial investment decision which ultimately affects the firm financial performance (Kim et al., 2009).

Moreover, Spence (1973) and Spence (2002) explained that higher growth data offers more authentic information about the underlying performance. It is also anticipated that companies with good performance have more incentives for higher growth, which shows the true picture of the firm and prevents adverse selection.

Thus, signaling theory explains that finance provider improves the firm growth with the help of disseminating market signal for asymmetric information mitigation, which will also reduce investor risk and improve firm performance. With the help of this discussion shows that firm growth influences supply chain finance and firm financial performance. Therefore, with this theory's help, a moderating link was established between supply chain finance and firm performance.

2.2 Supply Chain Finance

Supply chain finance (SCF) is an attention grabber area of researcher. There are three parallel flows in supply chain (product/services, information and financial flow) (Lambert et al., 1998a; Hofmann, 2011b). Product/services flow is about the product/services movement between suppliers and buyers.

Supply chain financial flow consists of all the finance related matters and move opposite direction from product/services flow. To align product/service flow with financial flow, the third flow is information, which consists of all the required information about products/services and financial matters. There are several definitions of SCF, and some SCF definitions explain the collaboration and coordination of supply chain finance in different flows.

Supply chain management is collaborating and coordinating different supply chain parties' goods flow, information, and finance flow optimization (Mentzer et al., 2001).

On the other side, Hofmann (2005) explained that supply chain finance is used between two or more organizations, which includes the external service provider joining the financial flow with organization by planning, negotiation and controlling.

After the 2008 financial crisis, the supply chain finance concept changed and focused on stabilizing all the supply chain finance flows and participants. With the prospects, Pfohl and Gomm (2009) defined supply chain finance more specifically. It is an inter-organization approach for financing and integrating the financial matters with customer, buyers, suppliers and finance providers to increase all the participants overall performance. This definition provides the base line that supply chain finance main objective is capital cost saving and a better understanding or new supply chain finance concepts (Franco, 2016).

Supply chain finance collaboration increases profit, gives a competitive advantage, and mitigates risk (Randall and Theodore Farris, 2009). Supply chain finance is a technique to solve trade finance problems and mitigate risk (Hofmann, 2013). Supply chain finance integration is designed to increase transparency and collaboration, reduce risk and cost, and improve the financial position of all participants overall.

The supply chain is further defined as the financial instrument use, its practices with different technology optimization and working capital management, and the supply chain process with business participants.

Suppliers and buyers must find different financing ways to operate their operations and payment methods without supply chain finance. When there is no mutual agreement, there is no leverage possibility for the buyer's creditworthiness. The decision is based on information provided by suppliers/buyers to the finance provider. In that case, the risk remains with all the parties.

Agreement with SCF

2.2.1 Supply Chain Finance Framework

Pfohl and Gomm (2009) conceptualized supply chain finance, which objects (assets) in supply chain finance by actors on which levers (terms) level. In figure 2.4, supply chain finance objects are referred to as long (fixed assets) and short (current assets), like working capital. Supply chain finance actors are primary (suppliers, customers) and supporting (finance, logistics providers). Lastly, it has three dimensions: assets

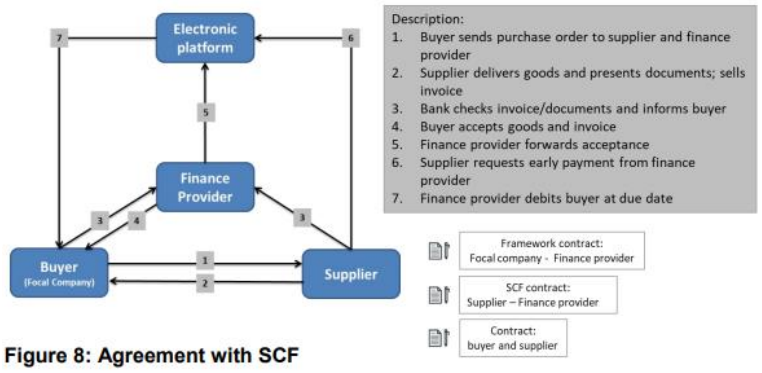

FIGURE 2.1: Agreement with Supply Chain Finance

amount (financing-volume) to get finance, time-period (financing-duration) and capital cost rate[1].

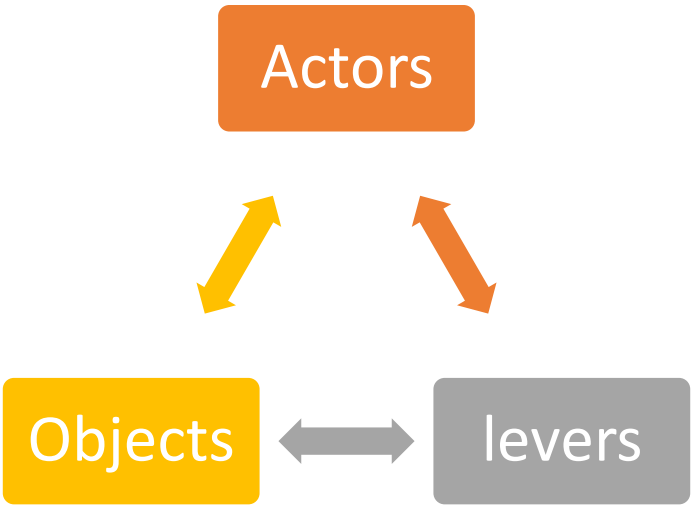

FIGURE 2.2: Supply Chain Finance

In SCF multiple the 3-levers give the capital cost which is the requirement of the company to generate profit over their investments::

Capital Costs (ϵ) = *Volume* (ϵ) *x Duration (time) x Capital Cost Rate (% time)* (2-1)

SCF influences all three levers: any increase or decrease in the financing amount (volume); accepting payment extension or reduction from the buyer time-period; or negotiating with the financial service provider about the cost of capital rate. It

[1]The capital cost rate is influenced by the company's financial structure (Weighted Average Cost of Capital approach), the expectations of investors regarding risk and return (usually acquired through the Expected Loss model), and external creditor demands

is important to consider that all three levers depend on each other. For example, time duration extension normally causes the cost of capital to increase. The main aim is to reduce capital costs because decreased capital costs increase shareholder value (Gomm, 2010).

The supply chain finance literature added that the financial service provider is supportive of providing finance. Furthermore, Hofmann (2005) conducted research in supply chain finance and service providers.

Firstly, supply chain finance actors must clarify, Figure 01, the actors' primary and supportive members. There should be at least two primary members for financial agreement in supply chain finance. The focal company can negotiate its creditworthiness to help the supplier directly with cheap financing rate (De Boer et al., 2015).

Furthermore, supply chain finance works as a network, not as a problem for organization and supplier relationships. The supply chain finance actors are involved in offering supply chain finance Buzacott and Zhang (2004), whose main purpose is to coordinate financial aspects with supply chain. There are two classifications of actors (primary and supportive) (Mentzer et al., 2001; Buzacott and Zhang, 2004; Gupta and Dutta, 2011).

The primary actors are buyers, suppliers, and finance providers, who are supportive actors. Financial service providers are divided into traditional banks, non-banking, and financial institutions (Chakuu et al., 2019). In literature, research focused on supply chain finance actors (buyers, suppliers) and focused on institutions like euro banking, supply chain working groups (Camerinelli and Bryant, 2014).

2.2.2 Supply Chain Finance Solution

Supply chain finance offers different solutions to finance assets. The following are the solutions:

2.2.2.1 Reverse Factoring

Reserve factoring is the payable solution, and it is offered to the supplier at the buyers risk. This SCF solutions buyers' working capital to improve supplier cash

flow through unpaid invoices. Another purpose of this solution is to strengthen suppliers relationships with the help of invoices that are early paid.

Reverse financing is buyer-oriented solution and the supplier agrees to receive the discounted value before actual time; typically, the cost is aligned with buyer credit risk (Van der Vliet et al., 2015).

Reverse factoring, also known as dynamic discounting, is a short-term financing tool initiated by buyers to get finance by using its account payable early from due date at a discount rate (Klapper, 2006).

2.2.2.2 Dynamic Discounting

It is also a payable financing solution offered by financial service providers. Dynamic discounting is the buyer-oriented trade process that provides a visibility platform for information communication technology (ICT) for dynamic invoice settlement in the buyer-supplier relationship (Gelsomino et al., 2016).

It is buyer-oriented, a short-term financing solution, and uses its own funds to pay the account payable before the due date at a discount rate.

More and Basu (2013), the dynamic discount mostly uses a sophisticated supply chain finance solution. It is a three corner of supply chain finance model (buyer, supplier and third-party financial institution or any IT platform). This SCF solution is used to reduce the uncertainty of working capital and improve cash flow for suppliers (Gelsomino et al., 2016). Generally, the dynamic discount solution offers the best rate in the buyer-oriented solution.

From the buyer's point of view, DD generally grants the best rate of return in todays markets. The methods also reduce trade process uncertainty.

2.2.2.3 Factoring

It is receivable financing, and the financer (factor) sells short-term receivables at a discounted rate. In the finance providers take the responsibility of underlying receivables payment collection (Kouvelis and Xu, 2021).

Factoring was already a common tool before the popularity of reserve factoring in the trade market. When supplier need cash, they used the factoring instrument for their long-term payment with receivables. It is a receivable purchase, in which suppliers sell their receivables to financial institutions. Difference between factoring and reserve factoring is that finance provider is accountable manager of borrowers and collect receivables payment. In factoring suppliers sell their receivables and received fast cash (Seifert and Seifert, 2009).

2.2.2.4 Accounting Receivable Financing

It also supplies chain finance receivable financing solutions, in which enterprises use their receivables as the underlying assets (Wang, 2017). Commercial banks provide loans against account receivables that have not yet been received (Ramezani et al., 2014). Two forms of accounts receivables financing are evident from the literature, i.e., accounts receivables pledging and accounts receivables financing.

2.2.2.5 Early Payment Discount Program

This supply chain finance solution is also receivable financing. Supplier offers a cash discount to buyer for early or quick payment. Chen et al. (2022), characterized and compared the optimal solutions in both BCF and early payment financing, which indicated that if the manufacturers production cost was not too high the retailer would prefer early payment financing to BCF.

"Early payment discount terms like 2/10 Net 30, 3/20 Net 60 are quite common in B2B trade. As was discussed earlier, availing of these discounts is extremely important for the buyer since they outweigh any other short-term investment option. With SCF providing early payment solutions, the treasurer has an additional option to settle accounts payables (A/P). They can pay the invoices either with their firms own cash reserves, or based on liquidity requirements, they can extend the payables and go for SCF-provided financing. Capturing early payment discounts with cash reserves is always worthwhile, as involving an intermediary requires profit sharing. But uncertainty in future cash flows is not obvious at each period whether and by what amount should the treasury use its own cash reserves or go for SCF financing" (Banerjee et al., 2021).

2.2.2.6 Inventory Financing

Some supply chain finance solutions are not linked with payable and receivable financing; they ae bases on loan/advance-based finance. Inventory finance is also a short-term finance that is taken from financial institutions to finance their inventories (Chen et al., 2022).

2.2.2.7 Purchase Order Financing

Purchase order financing is suppliers related, they get early payments from banks against their purchase orders which is issued by well-reputed buyers and risk is shared by banks with risk assessment of suppliers (Tang et al., 2018).

2.2.2.8 Pre-Selling:

In the solution, firms offer to sell products as much as possible at a discount rate before the selling season (Xiao and Zhang, 2018).

2.2.2.9 Trade Credit

Trade credit is also a type of supply chain finance solution, firms offer short-term loan against the exchange goods value and time tied by the supplier (Wang et al., 2020). Commercial banks offer trade credit financing, that is a B2B agreement buyer can purchase goods on credit (Yan and He, 2020).

2.2.2.10 Agricultural Supply Chain Finance

Supply chain finance solution for the agriculture sector, a financing mode for "re-harvesting", trade services finance and "post-harvesting". "Supply chain financing, generally pre-harvest, trade services financing, and post-harvest, is applied in the agriculture sector". Karyani et al. (2016) studied mango-sold farmers data and concluded that farmers needed financing schemes to operate their agribusiness. Research showed two financing modes: pre-harvest financing and trade to get supply chain finance. The mango agribusiness supply chain financing required

different contracts and agreements between supply chain actors and guarantee of institutions as a security.

2.2.2.11 Bank Guarantee

A Bank Guarantee is another supply chain finance solution; in this solution, banks give a promised guarantee from the debtors bank, which is the liability of debtor to repay in the case of repay failure (Martin and Hofmann, 2017).

2.2.2.12 Buy Back Guarantee

It is the kind of supply chain finance used by banks to settle the payment for capital-constrained retailers, all the settlement is bases on the supplier buyback guarantee. Chen et al. (2017), investigated the ordering/pricing decisions in a dyadic supply chain under the buy back guarantee mode. In another research, the newsvendor with budget-constrained problem is under risk averse with buy back guarantee and decision model of two-stage supply chain was made with quality order and wholesale price.

2.2.2.13 Credit Guarantee

Credit guarantee supply chain finance solution is timely payment promise by sound and deep-pocket manufacturers for retailers with high default risks. Yu et al. (2022), investigates the operational decision with capital-constrained manufacturer loans obtained from bank credit guarantee or closed-loop supply chain retailer.

Furthermore, pricing strategies and market entrance for a remanufacturer with bank credit financing also worthy in circular economy. Qin et al. (2020), researched supply chain carbon emission reduction with bank credit guarantee.

2.2.3 Supply Chain Finance Solutions and Firm Performance

Although the link between supply chain finance and financial performance has already been addressed, there is general lack of research on impact supply chain

finance solutions on the financial performance of financial service providers/banks or entire supply chain.

Gelsomino et al. (2016), reviewed 119 papers published from 2000-2014 and gave two perspectives of supply chain finance and financial performance. The finance-oriented perspective includes different supply chain finance solutions focused on the financial performance of financial institutions. The other perspective supply chain-oriented does not involve financial institutions and more focuses. Banks are financial institutions and linked with the finance-oriented perspective of supply chain finance solutions and their financial performance. Supply chain finance is a new emerging and innovative practice that has grabbed the attention of suppliers, buyers, and financial service providers (Jia et al., 2020).

Firm performance is an outcome of the business strategic and operations of conducted activities for the organization. When evaluating their market impact and growth, **?** states that firms are more concerned about their financial performance.

Pakurár et al. (2019), used supply chain integration dimension, customer integration, supplier integration and internal integration to measure financial performance of Jordanian Banks. Financial performance is one of the organization's major supply chain performance measures and use it to maximize shareholder profit (Huo, 2012a).

In the literature, financial performance is measured using two main approaches. The first approach to measure financial performance is based on subjective measurement about evaluation, competitors comparison and customer expectations. The second approach is based on the absolute measurement of financial performance such as ratio.

In literature, a number of studies have been used to identify the performance of banks such as Fernando and Herath (2019) in Kenya, Sari and Rahayu (2018) in Indonesia, Zainol et al. (2023) in United States of America. The performance of banks may vary due to different socio-economic dimensions, countries, regions, and time. However, literature witnessed the absolute measurement of financial performance measured using return on asset (ROA), return of equity (ROE)and Tobins Q ratio.

Ashiru et al. (2023), examined the association between financial innovation and financial performance of Nigerian deposit money banks data from 2012-2021. The results show that high financial innovation has a great impact on banks financial performance due to large innovational transactions witnessed in the banking sector.

YuSheng and Ibrahim (2020) examined the relationship between Internet banking as an innovation technique and banks financial performance for the period of 2005-2013 in 30 European countries with ROA and ROE ratios. The results find that there is a strong relation between internet bank innovation and banks financial performance.

Supply chain finance is a risk-shifting and profit-shifting system in different markets/economies which is also used to improve the performance of banks (Chen, 2016).

Supply chain finance solutions such as reverse factoring positively influence supply chain actors' financial performance (Klapper, 2006). Alabi et al. (2022), used 252 firms data listed on the London Stock Exchange to measure the financial performance using Tobins Q ratio and ROA. All the above studies are related to supply chain finance and contribute to financial performance. Thus, supply chain finance solutions improve and significantly enhance firm performance.

H_1: Supply chain finance solutions have a positive impact on financial service provider financial performance.

2.3 Supply Chain Finance Solutions and Financial Risk

2.3.1 Financial Risk

Risk is uncertainty about future outcomes or real monetary benefits that may be different from the expected value. Zhang et al. (2021) proposed the classifications of risk assessment system in supply chain; financial and business risks. Despite others, this study discusses financial risk and excludes the business risk from its domine.

Financial risk is the key challenge for all supply chain participants, especially for financial service providers (Kassi et al., 2019). The International Financial Reporting Standard number 7 classified financial risk into following categories: credit risk and capital adequacy ratio.

2.3.1.1 Credit Risk

Credit risk is the probability of loss or borrowers not paying the loan; other words, leaders fail to receive principal and interest. Several financial crises such as US financial system slump in 1980, Asian crisis of early 20s leads towards non-performing loans and increase credit risk. According to this, a loan is considered non-performing when payment is delayed more than 90 days.

Jabbouri et al. (2023) examined the banks' credit risk as the effect of non-performing loans on banks' performance in MENA emerging markets between 2000 and 2019 of 53 banks. The results show that a high level of non-performing loans significantly affects a bank's performance.

2.3.1.2 Capital Adequacy Ratio

Tier-1 capital ratio is considered an essential factor that enhances the firm performance. Different firms have different tier-1 ratio as more the ratio more the firm is at safer side of its risk. In the literature, Tier-1 significantly positively affects firm performance (Rangkuti, 2021). Sari and Rahayu (2018) explained that tier-1 capital ratio positively affects.

(Huo, 2012b) examined the relationshipbetween CAR and firm performance and concluded the restrictions on CAR indeed impact firm performance.

Furthermore, Irawati et al. (2019) studied the capital adequacy ratio with the Indonesian banking industry financial performance and concluded that CAR influence is significantly positive on financial performance of banks.

The banking sector's Capital adequacy ratio is very significant when different banks have different risk levels over their assets and capital. Antwi (2019) studied capital adequacy ratio with banks' performance and revealed that low capital adequacy ratio negatively affects the banks performance.

Capital adequacy ratio is the financial obligation of financial institutions (Morrison, 2002). Chen et al. (2017) examined the different risk effects seven countries of East Asian banks profit and cost of between between 2001-2008. The results showed that liquidity risk had a positive relationship with cost and a negative relationship with profit.

Gómez-Puig et al. (2023), investigate the dynamic connection between liquidity risk and credit risk of ten-euro area countries between 2008-2018 debt market. The results show that most of time, the connection is from credit risk to liquidity risk with condition to time; on the other side liquidity risk to credit risk.

(Nguyen and Nghiem, 2015) analyzed the relationship between efficiency and risk of banks in Indian banks for the period from 1994 to 2011and concluded an inverse relation between cost and risk.

Financial service providers' financial risk may be influenced by offering supply chain finance solutions. Thus, there is a relationship between supply chain finance solutions and financial service providers' financial risk.

2.4 Financial Risk and Financial Performance

Financial risk influence was examined with commercial banks financial performance (Sathyamoorthi et al., 2020). To measure the financial performance, used return of assets, return of equity and financial risk measured as loan-deposit ratio. The study sample consisted of ten commercial banks in Botswana from 2011 to 2018. The finding suggested that financial risk significantly negatively impacts financial performance. Another study examined the impact of financial risk on the financial performance of commercial banks. The independent variable was credit risk, liquidity, market and operational risk with dependent variable financial performance. In the study sample was 44 banks for the period of 2014-2018. With the help of multiple regression model analysis, results concluded that credit, market, liquidity and operation risk negatively affect firm financial performance.

One another study in Gulf Cooperation Council was examined by Shamas et al. (2018). The study used panel data set of seven Bahraini Islamic banks liquidity

risk, non-performing loans and capital adequacy ratio (CARs) impact on the return of average assets of banks, data for 2007-2011. The econometric outcomes show that liquidity risk depends on idiosyncratic risk. Results show that liquidity risk has a significant positive relation with financial performance. Non-performing loans and CARs have negative relation with performance. The above all literature discussion indicates that financial risk influences financial service providers' financial performance.

2.5 Supply Chain Finance Solutions, Financial Risk and Financial Service Provider Financial Performance

Supply chain management is collaborating and coordinating different supply chain parties' goods flow, information, and finance flow optimization (Mentzer et al., 2001). In literature,"Material and information flow studies have significant contributions; fund or finance flow has significant importance for the management of the other two flows in the whole supply chain. On the other hand, this area has not received much attention from either the academic or practitioner sideespecially in the financial service provider context."

Financial service providers like banks offered many loans and trade credit, but supply chain finance solutions offered by them were studied separately in the context of the buyer and supplier-oriented context, not as a context of the index of supply chain finance solutions.

In the recent past, traditional trade finance in the market was surpassed by supply chain finance. This new trend accelerates over time into three waves: supplier-oriented, buyer-oriented, and a mixture of buyer- and supplier-oriented solutions. With respect to who oriented these solutions, the financial service provider ultimately provides the fund flow to the supply chain parties.

The main aim of financial service providers or banks is to benefit from such opportunities, mitigate risk, and get involved in the global supply chain through these solutions to address all supply chain parties' evolving needs. Different studies

contribute to it as SCF can create a "win-win" situation for all the parties, like suppliers, buyers, and finance providers (Gelsomino et al., 2016; Wang et al., 2020).

Supply chain finance hasan important intersection of trade finance and the supply chain management field. Overall, all supply chain movement is to convert the material and information flow into the desired form along with the effective use of financial flows for all the parties in supply chain management (Davydov et al., 2017a).

Supply chain finance's basic idea is to deliver collective values to all parties of the (Cavenaghi, 2014). Selvaraj and Wesley (2020) added classic firm-oriented practices in supply chain finance, now extended to deal with cash-to-cash conversion cycle, WACC, cash flow management, receivables and payables.

No doubt finance and financial solutions integrate and optimize the supply chain resources. When in supply chain finance, financial service provider deals with finance and financial solutions it gives room to the financial risk on the banks and service providers in case of defaults. Common risks are liquidity, credit, market, and non-financial risks (Kassi et al., 2019).

All financial risk in the risk which can directly affect the company's financial position internally and in the market. Any fluctuation or return will lead to financial risk [95]. Financial risk is like an umbrella for multiple types of risk linked with financing, financial transactions, and default of company loans. Due to financial variables, movement in financial markets creates financial risk (Jorion and Khoury, 1996). Usually, it is linked with leverage and risk about all the due obligations and liabilities or not meeting with current assets.

Due to the asymmetry of information service provider, financial risk increases, and supply chain finance reduces this fact and reduces the uncertainty effect (Pfohl and Gomm, 2009; Shen et al., 2019). Many service providers may fail to evaluate small businesses' financial perspectives with conventional financing solutions (Moretto and Caniato, 2021). On the other side, service providers offer supply chain finance, and many substantial relevant business solutions and they maintain detailed transaction history and credit information for every supply chain participant (Xu et al., 2018).

Implicit and explicit factors can measure banks' financial performance. Bank-specific measurement may be Implicit or internal factors. On the other side, industry-specific measurement may be external or explicit factors. When a bank's basic internal factors are assessed, they can be bank assets growth, liquidity, operating performance, and capital adequacy. Industry-specific factors include bank size and ownership bank concentration index. There are some other factors from the macroeconomic side, including inflation, interest rate, GDP growth, and spread. When measuring firm financial performance and different financial decision phenomena Tobins q ratio is one of the indicators used in literature.

Morck et al. (1988) used Tobins q ratio to explain cross-sectional returns implying as a proxy for risk. Landsman and Shapiror (1995) used Tobins q to measure firm performance with relative importance of share effects and industry and focus. In literature, use of Tobins q ratio is not limited and used to measure firm performance.

All financial performance is to combine all the management factors which may be used for optimal profit achievement in any firm resources (Mansyur, 2017). Financial performance generally measures how banks generate capital revenue by using their resources (Toutou and Xiaodong, 2011) and is one of the primary goals to produce revenue (Suka, 2011).

Sathyamoorthi et al. (2020), examined the financial risk has a significant impact on financial performance. Financial success is measured by using ROA and ROE, net equity to total assets, gross debt to total assets, and loan-deposit ratio for financial risk management. For this analysis, the study population was 10 Botswana commercial banks with secondary data set time 2011-2018 using different research tests (descriptive statistics, correlation, and regression analysis). The study's finding was that interest rate had a significant negative effect on ROA and ROE.

Bolton et al. (2011) examined the financial risk relationship with ownership structure using Tobins q ratio and concluded that both financial risk or leverage and business risk significantly negatively impact inside ownership structure and firm financial performance. The above discussion highlights that supply chain finance solutions led to financial risk, and financial risk further influences financial service providers' financial performance.

Moreover, supply chain finance also affects the financial service providers' financial performance. Therefore, the above discussion shows that supply chain finance solutions significantly impact financial service providers' financial performance by low financial risk. Thus, the financial risk mediates the relationship between supply chain finance and financial service provider financial performance.

H_2: Financial risk mediates the relationship between supply chain finance solutions and financial service providers' financial performance.

2.6 Supply Chain Finance Solutions, Financial Visibility and Financial Service Providers Financial Performance

Financial visibility is the company ability to access key financial information and market performance which is accurate and easy to access. More the firm stock price leads to show company performance accurately. Different studies contributed to the body of knowledge of financial visibility. Most of the literature studied supply chain visibility. This study extended the literature by studying the financial visibility of firms offering supply chain finance and its impact on financial service provider financial performance.

Nose et al. (2021) examined financial visibility with investor attention and its effect on firm performance and concluded with high financial visibility, firm performance will also increase.

As most investors recognition increases it leads to firm valuation increases. This provides room for financial visibility. Merton et al. (1987) argues that all firms with less information or little-known have small investors who provide base to relatively high expected returns, leading to high stock price.

Increasing investors' attention may lead more optimistic investors to buy more stock and high stock price. Along stock price high stock volume may attract more investors attention (Miller, 1977)

Financial service providers face lower visibility over supply chain finance solutions transaction, as they are risk take and have less knowledge about the supply chain finance solutions taker and cannot check freely data about it (Pagell and Wu, 2009). Porasmaa and Ojala (2011), investigated visibility in supply chain is financial service provider's ability to access information and more bargaining power to reduce financial risk.

Less financial visibility results will affect financial service providers' financial performance (Prajogo and Olhager, 2012). A supply chain solution providers visibility towards its solutions taker alludes to the degree by which firms can get accurate and timely information about supply chain solutions taker and ultimately effect financial performance of firms (Basole and Bellamy, 2014). Financial visibility is a promising turn into a crucial part of mitigating financial risk (Klein and Rai, 2009).

The above discussion highlights that financial risk leads to financial visibility, and financial visibility further influences financial service providers financial performance. Therefore, the above discussion shows that financial risk significantly impacts financial service providers financial performance by high financial risk. Thus, financial visibility moderates the relationship between supply chain finance and financial service provider financial performance.

H_3: Financial visibility moderators the relationship between supply chain finance and financial service provider financial performance,such that the relationship between supply chain finance solutions moderates with financial service provider financial performance when financial visibility is high.

2.7 Supply Chain Finance Solutions, Firm Growth and Financial Service Providers Financial Performance

Supply chain finance is innovative and affects financial service providers' growth (Laeven et al., 2015). When a firm offers supply chain finance as a solution for trade

openness, it will enhance firm growth and overall financial performance (Davydov et al., 2017b).

Beck et al. (2016) studied financial innovation dark and bright impact on firm growth. The analysis used 32 countries data from 1996-2010 and concluded that high financial innovation has a significant positive effect on firm growth and financial performance.

Soedarmono et al. (2011) analyzed 12 Asian countries data from period of 2001-2007 about banking industry growth with financial performance. The research concluded that stronger growth has positive significant impact on financial performance.

Firm growth directly influences the financial performance of financial service providers with supply chain finance solutions. Thus, high firm growth improves the relationship between supply chain finance and financial service providers financial performance. Therefore, it is concluded that firm growth plays a moderating role in the relationship between supply chain finance and financial service providers financial performance.

H_4: Firm Growth moderates the relationship between supply chain finance and financial service provider financial performance such that the relationship between supply chain finance solutions and financial service provider financial performance is stronger when firm growth is high.

2.8 Control Variables and Firm Performance

In the study, firm-specific and country-specific variables were used as control variables for the biasness of the results.

2.8.1 Firm-Specific Control Variables

In the study, firm-level control variables were used to mitigate the biases of the results, e.g.,advances to assets ratio (AA), earning assets (EA) and, bank size (BS) usually are used as standard control variables in the studies with firm performance (Lambert et al., 1998b; Luo and Bhattacharya, 2009).

Control variable in this study is advances to assets ratio. This ratio is used to measure the firms total advances against total amount of assets. Advances to assets contributed to enhancing the firm performance as the lower the ratio more chance the firm performance also improves.

Nugraha et al. (2021), advances to assets ratio significantly impacts firm performance. Banks with lower ratio means bank have liquidity is high and less exposed to low defaults.

Moreover, Prabowo et al. (2018) examined the relationship between advances to assets ratio with bank performance and concluded that loan to assets has a significant negative effect on the return of assets bank financial performance.

Another firm-level control variable used in the study is the earning assets ratio. High earning assets ratio contributes more to the firm performance. Utami and Suprihati (2021a) studied the effect of earning assets on firm financial performance, and he contributed to the literature that simulant significant impact of earning assets on financial performance.

In another study, Utami and Suprihati (2021b) studied earning assets with the relationship of firm performance. The higher the earning assets the more the firm performs well.

The last firm-level control variable is firm size, which is an important considerable factor with firm performance. If the size of the firm increases, then there is more chance for the firm to generate external financing. All external financing is used to invest in new opportunities and impact the firm's financial performance. In more competitive market, big-size firms compete small-size firms with high market share and profit (Doğan, 2013). In literature, different studies explain the relationship between firm size and firm performance (Lee, 2009).

Majumdar (1997) explained the relationship between firm size and firm financial performance. There is another side of the firm size as some studies showed that more the firm size the chance of the firm financial performance (Opeyemi, 2019). Some studies cite the negative relationship between firm size and financial performance in the literature (Munjal et al., 2019).

2.8.2 Country-Specific Control Variables

Different micro and macroeconomic variables may influence the firm financial performance and business always working on to mitigate the negative impact of both micro and macro-economic variables on their financial performance (Issah and Antwi, 2017). But these micro-economic variables (interest rate, exchange rate & GDP growth) influence is uncontrollable and unavoidable, business are required to work on effect of macroeconomic factors forecasting for cashflow and firm performance (Broadstock et al., 2011).

In the literature, macroeconomic variables are used to control the influence on the dependent variable, which is the interest rate of Iqbal et al. (2020). GDP literature by Omran et al. (2008) and Baggs et al. (2009) studied exchange rate as control variable.

Gross domestic product is measured by the total market value of a country's products and services over a year (Soukhakian and Khodakarami, 2019). Gross domestic products and firm performance has positive relationship (Doan, 2020). Furthermore, there is a positive relationship between interest rate and firm financial performance (Hussain et al., 2021). In the study different countries data used and exchange rate also is a macro-economic variable to control its influence over dependent variable. There is also significant relationship between exchange rate and firm financial performance (Kelilume, 2016).

2.9 Chapter Summery

This chapter covered the details literature review of variables of the study and their relationships. The theoretical framework showing the graphical representation of variable is presented along with study hypothesis summary.

2.10 Conceptual Framework

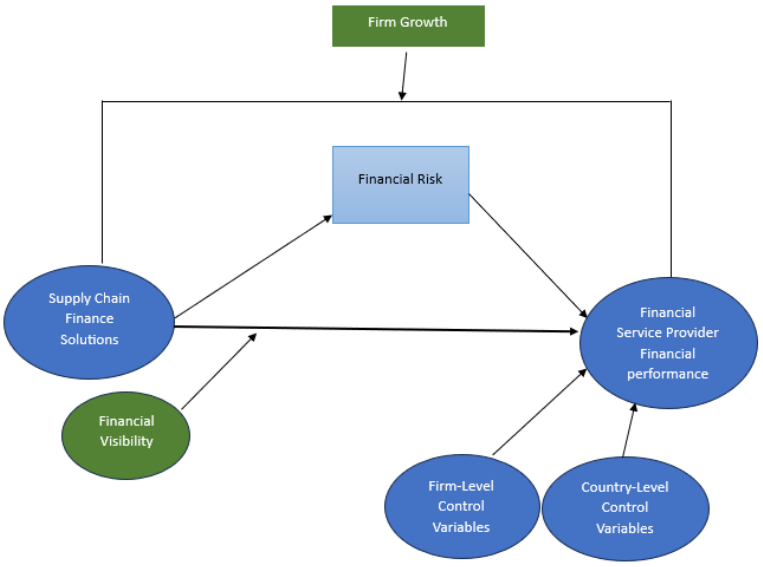

FIGURE 2.3: Conceptual Framework

2.11 Research Hypothesis

TABLE 2.1: Research Hypothesis

	Statements
H_1	Supply chain finance solutions have a positive impact on financial service provider financial performance.
H_2	Financial risk mediates the relationship between supply chain finance and financial service provider financial performance.
H_3	Financial visibility moderators the relationship between supply chain finance and financial service provider financial performance,such that the relationship between supply chain finance solutions moderates with financial service provider financial performance when financial visibility is high.

H_4	Firm growth moderates the relationship between supply chain finance and financial service provider financial performance, such that the relationship between supply chain finance solutions and financial service provider financial performance is stronger when firm growth is high.

Chapter 3

Research Data and Methodology

This study aims to check the supply chain finance solutions impact on financial performance of financial service providers. Secondly, this study explores the relationship of financial risk as mediator between supply chain finance solutions and financial performance. Thirdly, this study also discusses the moderating role of financial visibility and growth in the relationship of supply chain finance solutions and financial service providers financial performance.

This chapter includes details about population, sample, data source, variable measurement, and the econometric models to test the hypotheses. This chapter also explains hypotheses testing statistical techniques: descriptive statistics, correlation analysis, fixed-effect model and robustness test used to identify endogeneity and system Generalized method of moments.

Section 3.1 discussed population of the study. Section 3.2 discussed sample and time period. Section 3.3 provides the details of the research models. Section 3.4 provides the details of variables description. Section 3.5 provides the details of the control variables used in the study, 3.6 provide the details of statistical techniques and 3.7 section provide the details of research model

3.1 Population

Today, the world is a global village. There are number of financing or credit solutions providers to the business. In emerging and specifically developing countries, a

shortage of finance to run their business activity is always a matter of concern. There are number of institutions that offer finance to different businesses to meet their business financial needs. Specifically, after 2008 financial crises, banks started finance solution like supply chain finance to facilitate the business. With this context the financial service providers financial risk also matter of discussion.

Throughout the world, different financial institutions have started supply chain finance program. Asian Development Bank registered countries' banks with supply chain finance program as the focus of the study and considered as a Population 14 countries and 41 banks, remaining countries and financial service providers were part of the population. The main reason for selecting these countries is their prominence in emerging Asian region.

3.2 Sample

The sample of this study consists of 08 countries and 35 banks' data from 2012-2022 were used for data analysis. Due to data availability challenge, some banks have not active participation in supply chain finance program. To include that banks might dilute the insights, therefore, choosing 35 banks that are highly involved give more meaningful findings.

The Specific process used for countries and banks sampling is described in Table 3.1.

3.3 Data Collection

Banks' financial data have been collected from data stream, World Bank website, Asian Development website and bank's financial statements for the period of ten years (2012-2022). Supply chain finance solutions data has been extracted from each bank's website.

3.4 Variables Description

This section of the study defines dependent, independent, mediator, moderator, firm, and country-level control variables. The study analyses the impact of dynamic

TABLE 3.1: Sample

Countries	**Banks**
Pakistan	10
Bangladesh	9
China	2
Armenia	2
Georgia	2
Mongolia	2
Nepal	4
Sri Lanka	4
Total	**35**

supply chain finance solutions on the performance of financial service providers. Furthermore, study the relationship of financial risk as mediator between between supply chain finance and performance of financial service providers; also studies the financial visibility and growth influences as a moderator on financial service providers' performance with supply chain finance solutions. The analysis of the study is conducted at country and bank level.

3.4.1 Supply Chain Finance Solution (Independent Variable)

Supply chain finance involves optimizing inter-company financing and integrating financing processes with customers, suppliers, and service providers to enhance the value of all participating companies (Pfohl and Gomm, 2009). Various combinations of solutions are offered to facilitate supply chain finance financing.

In the literature, twenty-one supply chain finance solutions offered by different banks over various times are defined under the umbrella of supply chain finance Marak and Pillai (2018) (see Annexure-I). Data on these supply chain finance solutions were collected by visiting each bank's website. If a bank offers any solution listed in Annexure-I, it is marked as 1; otherwise, it is marked as 0. Subsequently,

the meaning of these values across all supply chain finance solutions is calculated to construct the supply chain finance solutions index.

Details for constructing the index are provided in the same section.

3.4.2 Financial Performance (Return on Assets) (Dependent Variable)

The dependent variable is firm performance and followed by the literature. Firm performance is measured in the literature by using return on assets (ROA) Watto et al. (2023). Return on assets is measured as

$$ROA = \frac{Net\ Income}{Total\ Assets} \tag{1}$$

The ROA is selected because the return on assets shows the management's ability to profit from the bank's assets.

3.4.3 Financial Risk (Mediator Variable)

Financial risk is the profitability of losing profit which is based on the bank's financial characteristics (Peng et al., 2011). The study used two proxies to measure financial risk. first credit risk which is measured with non-performing loans and second capital adequacy ratio. This risk affects the banks profitability and is a reason for the bank crisis. In many countries banks financial crisis main reason is banks financial risk which is mostly conveyed by the level of banks non-performing loans (NPL). Any loan that is not paid and due by the least 90 days is considered a non-performing loan (Tracey and Leon, 2011).

Non-performing loans is measured as

$$NPL = \frac{Total\ amount\ of\ NPL}{Gross\ Loans} \tag{2}$$

On the other side, capital adequacy ratio is the banks available capital that is on hand for its risk-weighted assets (Irawati et al., 2019). Furthermore, CAR provides a quick view that banks have enough funds to cover losses and remain solvent under difficult financial circumstances.

Secondly, this study used the second proxy, CAR ratio, to measure financial risk. The CAR is measured as:

$$CAR\ Ratio = \frac{Tier\ 1\ Capital + Tier\ 2\ Capital}{Total\ Deposits} \tag{3}$$

3.4.4 Financial Visibility (Moderator Variable)

Firm performance and valuation increase with an increase in recognition. An increase in Investors' attention gives optimistic investors view to buy the stock and leads toward high stock price (Opeyemi, 2019). Financial visibility occurs when a firm uses internal and external information to check its impact on its financial performance. Several studies illustrate that low stock price returns leads to high financial visibility (Mehran and Peristiani, 2010). The study anticipates that less liquid firms still lack an adequate analyst and higher stock price returns. The study used stock price returns as a proxy of financial visibility.

First, all banks' stock price data is collected and calculate the stock price return. Stock price returns is calculated as current stock price minus pervious stock price divided by pervious stock price. That stock price return values are used as financial visibility value. To calculate the moderating effect interaction term is created, multiplying the independent variable and financial visibility. The interaction term has been established by taking the product of supply chain finance index and financial visibility. This new variable has been included in the research equation. Which is used to capture the moderating role of financial visibility in the relationship between supply chain finance index and firm performance.

3.4.5 Firm Growth (Moderator Variable)

Firm growth is one of the primary interests and affects the financial performance of financial service providers. In literature bank growth is measured in different

ways: assets growth, profit growth, and loan growth (Beck et al., 2016). Assets growth is a proxy for year-on-year growth in the total assets with natural log as,

$$Assets\ Growth = natural\ Log(\frac{Current\ year\ Aeets - Pervious\ Year\ Assets}{Current\ Year\ Assets}) \tag{4}$$

Profit growth is calculated the proportion of year-on-year growth in the total profit with natural log as,

$$Profit\ Grwoth = natural\ Log(\frac{Current\ Year\ Profit - Pervious\ Year\ Profit}{Current\ Year\ Profit}) \tag{5}$$

Bank's loans growth is calculated their year-on-year growth with natural log as,

$$Loan\ Growth = natural\ Loan(\frac{Current\ Year\ Loan - Pervious\ Year\ Loan}{Current\ Year\ Loan}) \tag{6}$$

3.5 Control Variables:

Control variables in the study have their significance to mitigates the biased results (García-Sánchez, 2020). Adding control variables in the research equation means controlling any omitted variable biasness (Nguyen and Nghiem, 2015). In the study return on assets (dependent variable) is controlled on both firm and country specific level to minimize the results biasness.

3.5.1 Firm-Specific Control Variables

In previous studies advances to assets ratio, earning assets and bank size were used as control variables (Lam and Zhan, 2021; Luo and Bhattacharya, 2009). The following are the measurements of the control variables.

3.5.1.1 Advances to Assets Ratio

The advances to assets ratio is measured by dividing the total amount of debt to the total amount of assets.

By following Nugraha et al. (2021), advances to assets ratio is measured as,

$$Advances\ to\ Assets\ Ratio = \frac{Total\ Advances}{Total\ Assets} \tag{7}$$

3.5.1.2 Earning Assets Ratio

Banks assets are divided into two classes which is called earning and non-earning assets. Earning assets are that owned assets which produce income over their loan/investment. On the other side non-earning assets are banks total reserves Utami and Suprihati (2021b) . This study used earning-assets and measured as natural log earning assets.

$$Earning\ Assets = natural\ log(Earning\ Asets) \tag{8}$$

3.5.1.3 Bank Size

The study also used bank size as control variable and measured it with natural log of total assets.

$$B\ Size = natural\ log(total\ assets) \tag{9}$$

3.5.2 Macro-Economic Control Variables

3.5.2.1 Gross Domestic Products

In previous studies, GDP, interest, and exchange rates were used as control variables (Iqbal et al., 2020).

In any country, gross domestic product (GDP) is used as a standard measure of the value of production of goods and services for a certain time. It is measured as

$$GDP = natural\ log(Country\ GDP) \tag{10}$$

3.5.2.2 Interest Rate

Interest rate is measured as

$$IN = (Country\ Interest\ Rate) \tag{11}$$

3.5.2.3 Exchange Rate

Exchange Rate is measured as

$$EXG = natural\ log(Country\ Exchange\ Rate) \tag{12}$$

Table 3.2 display the use of all variable's summary, along with abbreviation and explanation of each variable.

3.6 Statistical Techniques

This study uses balanced panel data specifications to obtain the estimates of parameters by using a Pool OLS, FE model, RE model and robustness with system generalized method of moment (GMM) and fixed-effect estimators. The following sub-sections explain the two estimator's details.

3.6.1 Descriptive Statistics

Firstly, test the descriptive statistics for each variable in the study. Variables average value is measured by mean, and with standard deviation data, variation is shown. There are also minimum and maximum values presented in the descriptive statistics. The study shows descriptive statistics for all variables with all the countries and panel data. The mean value (average value) is measured by taking the sum of all values and divided by the number of all observations.

TABLE 3.2: Summary Measurement of all the Variables

Sr. No	Variables	Abbreviation	Explanation
Dependent Variable			
1	Financial Performance	FP	Financial performance is measured by scaling the net profit with total assets.
Independent Variable			
2	Supply Chain Finance Solution Index	SCFSI	Supply chain finance solution is measured as mark 1 if any bank offers it and 0 if any bank does not offer it from the list of 21 supply chain finance solutions. Supply chain finance solution index has been constructed based on principle component analysis (PCA).
Mediating Variable			
3	Financial Risk	FR	TThe study used credit risk ratio and capital adequacy ratio as proxy of financial risk.
Moderating Variables			
4.1	Financial Visibility	FV	The study used stock price returns as a proxy for financial visibility
4.2	Firm Growth	FG	The study used asset, profit, and loan growth as proxy for firm growth.
Bank-level Control Variables Variables			
5	Advances to Assets Ratio	AA	Total Advances/Total Assets
6	Earning Assets	EA	Natural log of earning assets
7	Bank Size	BS	Natural log of total assets
Macro-Economic Control Variables			
8	Gross domestic product	GDP	Natural log of country GDP
9	Interest Rate	IR	Country interest rate
10	Exchange Rate	EXG	Natural log of country exchange rate

$$ArtimaticMean = \frac{\sum X}{n} \tag{13}$$

$\sum$ X is sum of all variables and number of observations shown with n. Next, the standard deviation is measured by taking the sum of square of the deviation from the mean and dividing by number of observations. After that square root is taken of the results.

$$Standard\ Deviation = \sqrt{\frac{\Sigma\ (X - mean)^2}{n}} \tag{14}$$

Also, all variables' minimum and maximum values are in the descriptive statistics to identify the series range.

3.6.2 Correlation Analysis

In the study, correlation analysis shows the link between all the variables. Variables assessment is based on coefficient of correlation. The coefficient of correlation has a value from -1 to 1. If the correlation coefficient value is closer to zero, it means there is poor or weak correlation. Moreover, if the correlation of coefficient value is closer to -1 or 1, all variables have a strong relationship. Correlation analysis is also used to identify the issue of multi-co-linearity, and correlation is as high as 0.90 between independent variables (Hair et al., 2010).

3.6.3 Appropriate Methodology Selection

In the literature, various estimation techniques are employed to analyze results tailored to their suitability for specific situations. Common techniques include Pool Ordinary Least Squares (Pool OLS), Fixed Effect Model (FEM), Random Effect Model (REM), and the Generalized Method of Moments (GMM).

Do and Ta (2020) Doan (2020), conducted a meta-analysis of 340 research papers published in 32 different journals, drawn from 50 studies spanning 2004-2019, with a dataset covering 1998 to 2019. They found that 40% of studies used Pool OLS, 30% used Fixed Effect Model, 26% used Random Effect Model, and only 3% utilized GMM technique. Additionally, some studies employed mixed methods or combinations of these techniques (**??**).

Following this literature, our study employs Pool OLS, FEM, REM, and robustness techniques such as Difference or System GMM for estimation, conducted using EViews version 11 and STATA version 13 software.

We begin with the Pool OLS technique, which provides unbiased and consistent estimates if residuals are independent of explanatory variables. However, OLS

does not address heterogeneity and assumes constant coefficients across all units, leading to biased estimations of dynamic terms (Le and Phan, 2017).

To mitigate these issues, the Fixed Effect Model (FEM) and Random Effect Model (REM) are preferred over Pool OLS. The choice between FEM and REM is determined by the Hausman test Hausman (1978), which evaluates whether the model should account for individual-specific effects. However, transforming variables in these models can introduce bias, which is addressed through instrumental variable techniques (Marrero and Rodríguez, 2019).

Endogeneity is a significant concern in finance studies. Roberts Roberts and Whited (2013), which FEM and REM alone may not resolve due to issues such as autocorrelation and heteroscedasticity. These issues are often addressed using the GMM technique, specifically Difference GMM, which transforms data by differing independent and control variables to eliminate fixed effects. However, different GMMs may weaken results in unbalanced panel data sets.

To enhance efficiency and address these challenges, System GMM is recommended. System GMM expands on Difference GMM by incorporating additional instrumental variables that are exogenous and uncorrelated, accommodating all observations regardless of panel data balance.

3.6.4 Estimation Technique

The study utilizes panel data and estimates parameters using the fixed-effect estimator estimator and robustness analysis System Generalized Method of Moments (GMM). The following subsections

3.6.4.1 Fixed-effect estimator:

Panel data can generally be estimated using three methods: (a) Pool estimator with a common constant effect, (b) Fixed-effect estimator with cross-sectional fixed effects, and (c) Random effects estimator.

Pool OLS Method: This method assumes no differences between cross-sectional dimensions and data matrices, estimating a model with a common constant across

all cross-sections. It presumes the data is homogeneous a priori. Fixed-Effect Estimation (LSDV): In this approach, each cross-section has its own specific constant, represented by dummy variables for each group. The standard F-test is applied to determine the significance of fixed effects. It is used when the null hypothesis of homogeneous constants across all groups is rejected. Random-Effect Model: This estimation allows constants for each cross-section to have random parameters.

The Hausman test often guides the decision between fixed and random effects Hausman (1978), which checks for correlation between explanatory variables and fixed effects. If no correlation is found, both fixed and random effects are consistent, but the fixed effect is more efficient. However, if random effects are inconsistent and fixed effects are consistent, the fixed-effect model is preferred. The inclusion of year dummy variables is also a part of this study's estimation process.

In the literature, this study employs the fixed-effect estimation technique. This study incorporates a set of control variables to mitigate potential endogeneity issues arising from omitted variable bias.

3.6.4.2 Reason of Robustness Analysis

For any research robustness analysis is important test to confirm the reliability of data and confirm the data choice and model specification is not affect the research. This can helpful to ensure that results and different condition of data align. Further it helps to get assess the results changes sensitivity in the data or model. If in robustness results remain same and not variation found it increase the results trustworthiness

Robustness test also confirm that use of model is appropriate even use different estimation technique as robustness analysis, if changes appear mean the model is not appropriate. This is also helpful to remove the biases in the data set, for example if some outliers influence the results in robustness test that biases will be identify.

Further it also shows the thoroughness and diligence of the data analysis which give clearer picture to reader to find valid data results. Robustness test also

encounter the possible criticism to address using the fixed/random effect model. To confirm all these points for validating, model specification improvement, avoid biases, increase creditability, and results generalization, this study used robustness test system or difference Generalized Methods of Moments (GMM). By included this robustness test not only results are more reliable but provide more clearer and detail picture of research objectives.

3.6.4.3 System Generalized Methods of Moments (GMM)

This study uses robustness test system or difference Generalized Methods of Moments (GMM) to analyze the impact on supply chain finance solution index on financial service provider financial performance with the moderating role of financial visibility and firm growth and financial risk as mediators. Chatterjee and Nag (2023) identified while testing the firm risk and financial performance relationship, the different namely causes of endogeneity like unobserved heterogeneity, simultaneity, and dynamic endogeneity. They discussed that unobserved heterogeneity influences the two-variable relationship by unobserved factors. while on the other side simultaneity is due to the interdependence of two variables and dynamic endogeneity is due to the dependent variable current value impacted by the lagged value.

Panel data endogeneity is controlled by applying dynamic panel or GMM technique (Ullah et al., 2018; Tzouvanas et al., 2020). The Generalized method of moments is used to solve the endogeneity issue by taking the dependent variable lagged and proper lags on instrumental variables as endogenous variables (Chatterjee and Nag, 2023).

Therefore, the Generalized Methods of Moments (GMM) used as technique to address the endogeneity problem Busch Busch and Lewandowski (2018), and due to omitted variable bias or simultaneity may cause of endogeneity (Tzouvanas et al., 2020). There is ae two types of generalized method of moments: difference GMM and system GMM. In different GMMs, only differenced equations were taken, and on the other hand, GMM was taken when considering both difference and level equations. Furthermore, variable outcome persistence, small period, and autoregressive-term highly correlated indicated to apply system GMM (Blundell and Bond, 1998).

The GMM is used as a suitable technique to control the different kind of endogeneity and three main endogeneity types of controls are unobserved heterogeneity, simultaneity and dynamic endogeneity and validity of the GMM depends upon the Sargen test for instruments and model specification (Ullah et al., 2018). The study used the system Generalized Method of Moments by following (Ullah et al., 2018; Arellano and Bover, 1995). Generalized Methods of Moments (GMM) is used to estimate the validation based on two criteria (Fernando and Herath, 2019).

The first criterion to test the serial order existence of correlation and null hypothesis is that there is no serial order existence of correlation of differenced error term. The second criterion is the Sargan- Hansen test, which checks whether overidentifying restrictions are valid. In the study GMM criteria have been tested. AR (1) and AR (2) also added to the model and found in each model AR (2) is insignificant with p-value greater than 0.05, mean there is no serial correlation at lag-2 exists in the model and has been addressed. The Sargan- Hansen test results probability in my study more than 0.05, mean instrumental overidentifying restrictions is valid. Therefore, this study uses GMM technique as an additional check and robustness of results. All the equations run, and results are extracted by using EViews version 11 and STATA version 13 software.

3.7 Research Model

The research model employed aims to assess the impact of supply chain finance on firm performance, and the moderating roles of financial visibility and firm growth in the relationship between the supply chain finance index and firm performance are captured using regression equations. Firm performance, measured by return on assets (ROA), is proxied in each equation.

Each variable subscript (ct) denotes the country (c) and year (t). Firm-specific control variables are denoted as Bcon, while Con represents country-specific control variables.

3.7.1 Construction of Supply Chain Finance Solution Index

Data on the supply chain finance solutions were collected by visiting each bank's website. If a bank offers any solution listed in Annexure-I, it is marked as 1; otherwise, it is marked as 0. Subsequently, the meaning of these values across all supply chain finance solutions is calculated to construct the supply chain finance solutions index. The index is constructed using Principal Component Analysis (PCA).

The following equation is used to construct the supply chain finance solution index:

$$SCFSI_{ct} = \beta_0 + \beta_1 \sum_{i=1}^{21} SS_{ct} + \varepsilon_{ct} \tag{15}$$

Were SCFSI shows the Supply chain Finance Solution Index, SS shows all Supply chain finance solutions shows c country and t = time.

The purpose of creating this index is to provide a composite measurement of all supply chain finance solutions at the bank level. PCA is applied to aggregate and highlight significant information McNamara et al. (2011) while addressing issues like multicollinearity and statistical bias (Issah and Antwi, 2017). PCA selects dimensions that contribute most significantly while retaining relevant information and discarding irrelevant details.

FIGURE 3.1: Scree plot

TABLE 3.3: Supply Chain Finance Solutions Index Principal Component Analysis Results

Number	Value	Proportion	Cumulative Proportion
1	5.6428	0.2687	5.6428
2	2.881376	0.1372	8.524175
3	2.054664	0.0978	10.57884
4	1.888054	0.0899	12.46689
5	1.576342	0.0751	14.04323
6	1.212232	0.0577	15.25547
7	1.025159	0.0488	16.28063
8	0.91801	0.0437	17.19864
9	0.696246	0.0332	17.89488
10	0.608874	0.0290	18.50376
11	0.542899	0.0259	19.04665
12	0.402711	0.0192	19.44937
13	0.386001	0.0184	19.83537
14	0.321251	0.0153	20.15662
15	0.297450	0.0142	20.45407
16	0.205455	0.0098	20.65952
17	0.158798	0.0076	20.81832
18	0.133907	0.0064	20.95223
19	0.047772	0.0023	21.00000
20	2.90E-16	0.0000	21.00000
21	9.83E-17	0.0000	21.00000

On the base of PCA results Table 3.3. all the factors values greater than 1 or 1 retained and factors below 1 discarded. After principal component analysis, 14 component was extracted on the base of eigenvalue greater than 1. All the components value greater than 1 has significant contribution to the data variance. The first 3 components have high contribution, the first component (5.6428) has approximately 26.87

Further scree plot 3.1 also confirms these findings, elbow visualization after seven components confirms that only greater than 1 point component are relevant for retention. The second component captured the supply chain finance solutions essential features across the countries can visualize in the scree plot. These components retain in the index creation provides the comprehensive measurement and all reflection of supply chain finance solutions.

3.7.2 Impact of Supply Chain Finance Solutions Index on Financial Service Providers Financial Performance

The following equations are used to measure the impact of supply chain finance solution on financial service providers' financial performance with fixed effect and system generalized method of moment (GMM), respectively,

$$ROA_{ct} = \beta_0 + \beta_{01} SCFSI_{ct} + \sum_{(c=1)}^{3} \gamma_i Bcon_{ct} + \sum_{(c=1)}^{3} \delta_i con_{ct} + \varphi_i \sum Year + \sigma_i \sum Country + \mu_i + \varepsilon_{ct} \quad (16)$$

In equation 3.16, ROA shows return on assets, SCFSI shows Supply chain finance index Bcon consists of three bank control variables advances to asset ratio (AA), earnings assets (EA), bank size (BS) and vector Con consists 3 country control variable gross domestic production (GDP), interest rate (IR) and exchange rate (ER). $\sum$year and $\sum$country is used year/country dummy variables, u_i is the entity

$$ROA_{ct} = \beta_{01} + \beta_2 \theta ROA_{(t-1)} + \beta_3 SCFSI_{ct} + \sum_{(c=1)}^{3} \gamma_i Bcon_{ct} + \sum_{(c=1)}^{3} \delta_i con_{ct} + \varepsilon_{ct} \quad (17)$$

In equation 3.17, θ captures the dynamic effect, ROA shows return on assets, SCFI shows Supply chain finance index Bcon consists of three bank control variables advances to asset ratio (AA), earnings assets (EA), bank size (BS) and vector Con consists 3 country control variable gross domestic production (GDP), interest rate (IR) and exchange rate (ER). $\sum$year and $\sum$country are used year/country dummy variables, u_i is the entity specific variable and ε is the error term.

3.7.3 Mediating Role of Financial Risk in the Relationship of supply chain solutions finance solutions index and Financial Service Providers Financial Performance

To capture the mediation role of financial risk this study used two proxies used credit risk which is measured with non-performing loans and capital adequacy ratio. The study used the principal component analysis (PCA) to measure the financial risk and measures as following:

$$FR_{ct} = \beta_0 + \beta_1 CR_{ct} + \ \beta_2 CAR_{ct} + \varepsilon_{ct} \tag{18}$$

Where CR shows credit Risk, SS shows non-performing loans, CAR shows capital adequacy ratio.

Table 3.4: Financial Risk Principal Component Analysis Results

Number	Value	Proportion	Cumulative Proportion
1	1.036475	0.5182	0.5182
2	0.963525	0.4818	1.0000

Financial risk PCA results for two components have been shown in the above Table 3.4. The eigenvalue of first component is 1.0365 and explaining the 51.82% of total variance. This indicating that significant contribution of non-performing loans in the financial risk. The second component, eigenvalue is 0.9635 explaining the total variance 48.18%. although the second component is near to threshold of 1 to retain the component but overall showing the value 1 a suggesting that capital adequacy ratio provides some insights information into financial risk. First component is the primary driver to captured the essential characteristics of financial risk.

The following equations 3.19 to 3.26 have been used to measure the mediating role of financial risk in the relationship of supply chain finance and financial service providers financial performance with fixed effect and system generalized method of moment (GMM) and measures as following:

3.7.3.1 Impact of Supply Chain Finance Solutions Index on Financial Risk

Path a equation

$$FR_{ct} = \beta_{02} + \beta_4 SCFI_{ct} + \sum_{(c=1)}^{3} \gamma_i Bcon_{ct} + \sum_{(c=1)}^{3} \delta_i con_{ct} + \varphi_i \sum Year + \sigma_i \sum Country + \mu_i + \mu_{ct} \quad (19)$$

$$FR_{ct} = \beta_{03} + \beta_5 \theta FR_{(t-1)} + \beta_6 SCFSI_{ct} + \sum_{(c=1)}^{3} \gamma_i Bcon_{ct} + \sum_{(c=1)}^{3} \delta_i con_{ct} + \varepsilon_{ct} \quad (20)$$

3.7.3.2 Impact of Financial Risk on Financial Service Provider Financial Performance

Path b equation

$$ROA_{ct} = \beta_{04} + \beta_7 FR_{ct} + \sum_{(c=1)}^{3} \gamma_i Bcon_{ct} + \sum_{(c=1)}^{3} \delta_i con_{ct} + \varphi_i \sum Year + \sigma_i \sum Country + \mu_i + \mu_{ct} \quad (21)$$

$$ROA_{ct} = \beta_{05} + \beta_8 \theta ROA_{(t-1)} + \beta_9 FR_{ct} + \sum_{(c=1)}^{3} \gamma_i Bcon_{ct} + \sum_{(c=1)}^{3} \delta_i con_{ct} + \varepsilon_{ct} \quad (22)$$

3.7.3.3 Impact of Supply Chain Finance Solutions Index on Financial Service Provider Financial Performance

Path c equation

$$ROA_{ct} = \beta_{06} + \beta_{10} SCFSI_{ct} + \sum_{(c=1)}^{3} \gamma_i Bcon_{ct} + \sum_{(c=1)}^{3} \delta_i con_{ct} + \varphi_i \sum Year + \sigma_i \sum Country + \mu_i + \mu_{ct} \quad (23)$$

$$ROA_{ct} = \beta_{06} + \beta_{11} \theta ROA_{(t-1)} + \beta_{12} SCFSI_{ct} + \sum_{(c=1)}^{3} \gamma_i Bcon_{ct} + \sum_{(c=1)}^{3} \delta_i con_{ct} + \varepsilon_{ct} \quad (24)$$

3.7.3.4 Impact of Supply Chain Finance Solutions Index and Financial Risk on Financial Service Provider Financial Performance

Path full equation

$$ROA_{ct} = \beta_{08} + \beta_{13} SCFSI_{ct} + \beta_{14} FR_{ct} + \sum_{(c=1)}^{3} \gamma_i Bcon_{ct} + \sum_{(c=1)}^{3} \delta_i con_{ct} + \varphi_i \sum Year + \sigma_i \sum Country + \mu_i + \mu_{ct} \quad (25)$$

$$ROA_{ct} = \beta_{09} + \beta_{15} \theta ROA_{(t-1)} + \beta_{16} SCFI_{ct} + \beta_{17} FR_{ct} + \sum_{c=1}^{3} \gamma_i Bcon_{ct} + \sum_{c=1}^{3} \delta_i con_{ct} + \varepsilon_{ct} \quad (26)$$

In the all above equations from 3.19-26, ROA represents the return on assets, θ sign captured the dynamic effect, SCFSI shows the supply chain finance solution index, FR represents the financial risk and Bcon represents vector of bank specific controls advances to asset ratio (AA), earnings assets (EA), bank size (BS) and Con represents vector of macro-economic controls (GDP, interest rate, exchange rate). $\sum$year and $\sum$country is used year/country dummy variables, u_i is the entity.

The study evaluates the mediating role of financial risk in the relationship between supply chain finance and financial service providers financial performance, in addition to the moderating role of financial visibility and firm growth. By following Baron and Kenny (1986); Khan et al. (2021), a three-step analysis is applied to indicate the mediating role of financial risk in the relationship of supply chain finance solution with financial service providers financial performance.

In the first step (path a), a mediator is considered an independent variable's function. In the second step (path b), a dependent variable is considered a mediator's function. In the third step (path c), the dependent variable is considered a function of the independent variable. If all coefficients of the estimators are significant across these paths, then the mediating effect of the mediator is confirmed.

The fourth step (full path) involves analyzing the dependent variable as a function of the independent and mediator variables. If the coefficient of the independent variable remains significant in this full model, then partial mediation of the mediator exists. If the coefficient of the independent variable becomes non-significant, then full mediation is considered to occur.

3.7.4 Moderating Role of Financial Visibility in the Relationship of Supply Chain Finance Solutions Index and Financial Service Providers Financial Performance

The following regression equations were used to capture the financial visibility as a moderating effect in the relationship of supply chain finance solution index and financial service providers' financial performance with fixed effect and system generalized method of moment (GMM), and measures as following:

$$\begin{aligned} ROA_{ct} = {} & \beta_{10} + \beta_{18} SCFI_{ct} + \beta_{19} FV_{ct} + \beta_{20} (SCFI \times FV)_{ct} \\ & + \sum_{c=1}^{3} \lambda Bcon_{ct} + \sum_{c=1}^{3} \alpha_1 con_{ct} \\ & + \varphi_i \sum \text{Year} + \sigma_i \sum \text{Country} + \mu_i + \varepsilon_{ct} \end{aligned} \tag{27}$$

$$\begin{aligned} ROA_{ct} = {} & \beta_{11} + \beta_{21} \theta ROA_{t-1} + \beta_{22} SCFI_{ct} + \beta_{23} FV_{ct} \\ & + \beta_{24} (SCFI \times FV)_{ct} + \sum_{c=1}^{3} \lambda Bcon_{ct} \\ & + \sum_{c=1}^{3} \alpha_1 con_{ct} + \mu_{ct} \end{aligned} \tag{28}$$

Where in equation 3.27-28, ROA shows return of assets, θ shows the dynamic effect, SCFI shows Supply Chain Finance Index, FV represents financial visibility, SCFI $\times$ FV represents the interaction term, Bcon represents vector of bank specific controls advances to asset ratio (AA), earnings assets (EA), bank size (BS) and

Con represents vector of macro-economic controls (GDP, interest rate, exchange rate).

3.7.5 Moderating Role of Firm Growth in the Relationship of Supply Chain Finance Solutions Index and Financial Service Providers Financial Performance

The following regression equations are used to capture the firm growth as a moderating effect in the relationship of supply chain finance and financial service providers' financial performance with fixed effect and system generalized method of moment (GMM), respectively. After calculating the assets growth, profit growth and loan growth, the study used the principal component analysis (PCA) by using equation 3.29 and measure as following:

$$GR_{ct} = \beta_{02} + \beta_1 AG_{ct} + \beta_2 PG_{ct} + \beta_3 LG_{ct} + \varepsilon_{ct} \tag{29}$$

Where GR shows firm growth, AG assets growth, PG shows profit growth, LG shows loan growth and ε is the error term.

TABLE 3.5: Firm Growth Principal Component Analysis Results

Number	Value	Proportion	Cumulative Proportion
1	1.033723	0.3440	0.3446
2	1.000000	0.3330	0.6783
3	1.000000	0.3330	1.0000

The aboveTable 3.5. of PCA for firm growth shows that the significant contribution of the variables in the data set. The 1st components eigenvalue explained the 34.4% values in the total variance. This value shows that this component has key contribution in firm growth. The second and third component shows the 33.33% value in the total variance individually. All together these components explain the 100% data variance. On the base of cumulative value 1t component shows almost the loan growth captured the maximum variance, 2nd and third are assets and profit growth respectively captured the variance in the growth data.

$$\begin{aligned} ROA_{ct} =& \beta_{12} + \beta_{25} SCFI_{ct} + \beta_{26} GR_{ct} + \beta_{27} (SCFI \times GR)_{ct} \\ &+ \sum_{c=1}^{3} \lambda Bcon_{ct} + \sum_{=1}^{3} \alpha_1 con_{ct} \\ &+ \varphi_i \sum Year + \sigma_i \sum Country + \mu_i + \varepsilon_{ct} \end{aligned} \tag{30}$$

$$\begin{aligned} ROA_{ct} =& \beta_{13} + \beta_{28} \theta ROA_{t-1} + \beta_{29} SCFI_{ct} + \beta_{30} (SCFI \times GR)_{ct} \\ &+ \beta_{31} GR_{ct} + \sum_{c=1}^{3} \lambda Bcon_{ct} + \sum_{=1}^{3} \alpha_1 con_{ct} + \mu_{ct} \end{aligned} \tag{31}$$

In equation 3.30-31, ROA shows returns on Assets, θ shows the dynamic effect, SCFSI= Supply chain finance index, GR =Firm Growth, SCFI $\times$ GR = Firm Growth interaction term Bcon represents vector of bank-specific dvances to asset ratio (AA), earnings assets (EA), bank size (BS). Con represents vector of macro-economic controls (GDP, interest rate, exchange rate)

3.8 Chapter Summery

This chapter discussed the detail of research population, sample, data collection and variable descriptions along with country-level control variables and macro-economic variables. Further, details of statistically techniques, appropriate methodology selection, detail of robustness analysis. Finally, detail research model's equations to measure the hypothesis was also presented.

Chapter 4

Empirical Results and Research Discussions

This chapter is about the results obtained by applying the suitable technique, i.e., fixed effect model and robustness test system GMM, to test the hypothesis. In this chapter, descriptive statistics, correlation, Fixed-effect model and System GMM results have been described.

4.1 Descriptive Statistic

Table 4.1 shows the descriptive statistics results of the variables, i.e., return on assets, supply chain finance, financial risk, financial visibility, firm growth, advances to assets ratio, earning assets, bank size, gross domestic product, Interest rate, exchange rate.

The mean value of return on assets is 41% indicating a moderate profit and moderate variation across the banks with 58% standard deviation. The results also consisting of skewness values and indicates its distribution on right-skewed as values are adjusted at the lower end with very high values. Near to 3 value of kurtosis shows a ROA distribution approximately normal. JB statistics is 1.85.

The mean value of supply chain finance index is 0.89 and standard deviation is 3.42, skewness and kurtosis values are -0.14 and 3.08 respectively with normal distribution of JB statistics 2.3. Financial risk average value is -1.84 with standard deviation

1.33, skewness and kurtosis values are -0.32 and 3.95 respectively. Financial visibility average value is 0.07 with standard deviation 1.3. Banks growth average mean value is 0.01 with deviation in data 1.25. positive skewness indicates that there are low-growth banks and few with higher-than-average growth in banks.

Table 4.1: Descriptive Statistics

Variables	Mean	Maximum	Minimum	Standard Deviation	Skewness,	Kurtosis	JB Statistics
RETURN ON ASSETS (ROA)	0.41	3.75	0.001	0.58	0.45	4.01	1.85
SUPPLY CHAIN FINANCE INDEX (SCFI)	0.89	6.05	-9.9	3.42	-0.14	3.08	2.3
FINANCIAL RISK (FR)	-1.84	5.15	-2.75	1.33	-0.32	3.95	1.95
FINANCIAL VISIBILITY (FV)	0.07	1.3	-1.36	0.34	-0.11	5.88	1.7
GROWTH (GR)	0.01	4.88	-3.08	1.25	0.22	4.9	1.65
Advances TO ASSETS RATIO (AA)	0.54	2.01	0.04	0.35	0.47	2.93	1.75
EARNING ASSETS (EA)	0.69	4.6	0.02	0.42	0.33	3.2	2.1
BANK SIZE (BS)	13.05	25.3	0.35	4.25	0.55	4.18	2.3
GROSS DOMESTIC PRODUCT (GDP)	1.55	2.5	-2.3	0.85	-0.32	5.18	2.15
INTEREST RATE (IR)	1.1	2.35	-1.34	0.41	0.09	3.88	1.68
EXCHANGE RATE (ER)	4.5	8.2	0.5	1.4	0.4	3.15	2.25

4.2 Correlation Analysis

In Table 4.2 reported correlation analysis results of panel. Correlation analysis results show the relationship between the variables of the study.

4.2.1 Panel Correlation Analysis

Panel data correlation analysis data of return on assets (ROA), results show a negative relationship with supply chain finance solutions index and a positive relationship between financial risk, financial visibility, and firm growth. The supply chain finance solutions index shows positive relationship with financial visibility and negative relationship with financial risk and firm growth. Financial risk correlation results are negative with financial visibility and positive with firm growth. Firm growth and financial visibility have a negative relationship. There are no serious correlation issues between the variables regarding multi-co-linearity. If correlation is high or greater than 0.90 between variables, it may result in a multi-co-linearity (Hair et al., 2010).

Table 4.2: Panel Correlation Analysis

	ROA	SCFSI	FR	FV	GR	AA	EA	BS	GDP	IR	ER
ROA	1										
SCFSI	-0.033	1									
FR	0.191	-0.3	1								
FV	0.061*	-0.126	0.128	1							
GR	0.038	-0.229	0.861	0.117	1						
AA	0.021	0.075*	0.099*	0.071*	0.131	1					
EA	0.076*	-0.085*	0.397	-0.026	0.461	-0.042	1				
BS	-0.344	-0.084*	0.074*	0.105	0.362	-0.001	-0.045	1			
GDP	-0.085*	-0.131	-0.128	-0.16	-0.337	0.035	-0.122	-0.27	1		
IR	-0.139	0.14	-0.069*	-0.088*	-0.007	-0.044	-0.006	0.076*	-0.045	1	
ER	0.122	-0.131	-0.128	-0.16	-0.337	0.085*	-0.181	0.098*	0.258	-0.165	1

*Note: ROA=Return on assets, SCFSI= Supply chain finance solutions index, FR= Financial risk, FV= Financial visibility, GR=Growth, AA= Advances to assets ratio, EA= earning assets, BS=Bank size, GDP=Gross domestic product, IR= Interest rate, ER= Exchange rate,. * * *P < 0.01, * * P < 0.05, * P < 0.1*

In the panel data, return on assets is highly correlated with financial risk (0.191) and low correlation is with supply chain finance solutions index (-0.033). Supply chain finance is highly correlated with financial visibility (-0.126) among all variables, and the low correlation is (-0.3). financial risk and firm growth correlation is (0.861), and financial visibility correlation is (0.128).

4.3 Unit Root Panel Test Results

In the following Table 4.3, the unit root test results are mentioned with the P-value of the Levin-Lin-Chu unit root test. The Ho is the unit root of panel and alternative hypothesis is H1: this panel is stationary.

TABLE 4.3: Unit Root Test

Sr. No	Variables	P-Value of Levin Lin-Chu unit root test	Status
1	ROA	0	Stationary at a level I (0.000)
2	SCFSI	0	Stationary at a level I (0.000)
3	FR	0	Stationary at a level I (0.000)
4	FV	0	Stationary at a level I (0.000)
5	GR	0	Stationary at a level I (0.000)
6	AA	0	Stationary at a level I (0.000)
7	EA	0	Stationary at a level I (0.000)
8	BS	0	Stationary at a level I (0.000)
9	GDP	0	Stationary at a level I (0.000)
10	IR	0	Stationary at a level I (0.000)
11	ER	0	Stationary at a level I (0.000)

Note: ROA=Return on assets, SCFSI= Supply chain finance solutions index, FR= Financial risk, FV= Financial visibility, GR=Growth, AA= Advances to assets ratio, EA= earning assets, BS=Bank size, GDP=Gross domestic product, IR= Interest rate, ER= Exchange rate.

Unit root analysis results show that levin Lin-Chu test P-value is less than 0.05 for all the study variables. This significance level shows that alternative hypothesis

is accepted with all variables are stationary at level I (0.0000) and can used for regression analysis.

4.4 Hausman Test

Different estimation techniques used in literature to association between banks financial performance and supply chain finance. The most widely used method fixed/random effect model.

In the study, estimation is based on fixed effect model (FEM) or random effect model (REM). Hausman test is applied to choose between the fixed-effect model and random-effect model. The null hypothesis of this test is that REM is preferred over FEM. P-value <0.05 reject the null hypothesis supports FEM, whereas the hypothesis accepted at P-value>0.05 and support REM.

TABLE 4.4: Hausman Test

	ROA-Panel
SCFSI	16.695***

**** P<.01, ** P<.05, * P<.1*

Table 4.4 shows Hausman test results, to obtain the results with random effects model. Control variables are also part of regressors. The Hausman test show that the null hypothesis is rejected which mean FEM is preferred over REM.

4.5 Supply Chain Financial Solutions Index and Financial Service Provider's Financial Performance

This subsection examines the impact of the Supply Chain Finance Solutions Index on the financial performance of financial service providers using panel data from 35 banks across 8 countries participating in the Asian Development Bank's Supply

Chain Finance Program from 2012 to 2022. The analysis employs fixed effects models, incorporating year and country dummies to control for unique yearly effects, ensuring more precise and meaningful results.

H_1: Supply chain finance solutions have a positive impact on financial service provider financial performance.

Equation (16) is employed, for results presented in Table 4.5 based on fixed effects. Model-I regress with all control variables, all the control variables as bank-level and macro-economic level shows significant impact. Advances to assets ration shows positive significant impact as 1

Along with bank control variables macro-economic control variables gross domestic product interest rate and exchange rate also shows significant impact. Interest rate and exchange rate shows negative impact GDP has significant positive impact. Model-II shows result of supply chain finance solution index effect on firm performance measured with return on assets. The Supply Chain Finance Solutions Index demonstrates a significant positive impact (β=0.077) at the 1% significance level on the financial performance of financial service providers. 1% increase in supply chain finance solution index will increase 0.077% in return on assets. The adjusted R-square in model-II is 0.7670. In model-II control variables also has significant impact with advances to assets ratio, earning assets, bank size and GDP has significant positive and interest rate and exchange rate negative impact.

Use GDP as control variable is as its economic indicator of economic health. Higher GDP increase banking services demand which can affect the supply chain finance solutions index impact of ROA. The reason to use interest rate as control variables is when assess supply chain finance solution index impact on ROA is independent of financial environment. Further exchange rate as take control variable is when a stable exchange rate can increase export and lead towards high banking service demands including SCF. When control exchange rate it will isolate the SCFSI effect on ROA from currency fluctuations effect

Continuing with fixed effect panel results presented in Table 4.5, the overall analysis indicates a significant positive impact of the Supply Chain Finance Solutions Index across the countries studied, with a coefficient of 0.08 and a notable p-value of

TABLE 4.5: Impact of Supply Chain Finance Solution Index on Firm Performance

Variables	**Model-I**	**Model-II**
SCFSI		0.077*
		-1.8757
AA	0.577**	0.633**
	-2.985	-2.244
EA	0.654**	0.035**
	(-0.005)	-2.1016
BS	0.002*	0.001
	(-0.297)	-0.5024
GDP	0.044**	0.064*
	-2.246	-1.8017
IR	-0.09*	-0.108*
	(-1.873)	(-1.1851)
ER	-0.22**	-0.115*
	(-2.225)	(-0.5481)
Intercept	1.3031	1.4778
	-2.83	-1.1797
No of observation	374	374
Time effect	Yes	Yes
Country effect	Yes	Yes
F-statistic	30.649***	31.403***
Adjusted R2	0.7561	0.767

*Note: ROA=Return on assets, SCFSI= Supply chain finance solutions index, AA= loan to assets ratio, EA= earning assets, BS=Bank size, GDP=Gross domestic product, IR= Interest rate, ER= Exchange rate. * * *P < 0.01, * * P ¡ 0.05, *P < 0.1 Parenthesis= (P-value, significance)*

0.001. This underscores the varying yet generally beneficial influence of supply chain finance solutions on enhancing financial service provider performance.

The existing literature presents mixed findings regarding the impact of supply chain finance on financial service provider performance. According to reference Arellano and Bover (1995), supply chain finance solutions generally have a positive effect on financial performance. Supply chain finance solutions are the new transformed way to give finance to the business. But from financial service provider side they always work on to introduce such financing techniques which enhance their overall performance. all the countries in the panel data set transforming their traditional

trade or finance methods to new ways to finance in the market. Different banks registered with ADB bank to introduce new financing ways with the attention to improve their financial performance.

Straka et al. (2021), for instance, studied Jordanian banks and concluded that supply chain finance significantly enhances financial performance. Financial performance, a key metric in supply chain operations, is crucial for maximizing shareholder profit (Huo, 2012b).

Supply chain finance represents an innovative approach to financing supply chain parties, though it can occasionally have a negative impact on financial service providers' performance. Nonetheless, literature predominantly supports its positive impact (Bi et al., 2022). This study's findings align with existing research, suggesting that supply chain finance indeed benefits financial service providers' performance.

SCF such as reverse factoring, factoring purchase order finance is allowing banks to offer different short-term financing to buyers and suppliers. With this bank can use effectively their available assets for loans/advances which will increase their interest-earning assets.

Along with interest income, SCF also is a source of to generate service fees, processing fees and transactions fee, this will enhance total revenue and positively impact on ROA. SCF is an ongoing relationship between SC parties, which is providing stable platforms to banks to lead a sustained use of assets and high profit over time

Moreover, according to bargaining power theory discussed by Kuhn et al. (1983), financial service providers wield considerable bargaining power by offering supply chain finance solutions, which can enhance their financial performance (Crook and Combs, 2007). Despite the risks associated with offering supply chain finance, financial service providers may leverage their risk-taking abilities to assert bargaining power, thereby influencing their financial performance positively.

The hypothesis H_1:Supply chain finance solutions have a positive impact on financial service provider financial performance is accepted.

4.6 Mediating Role of Financial Risk in a Relationship of Supply Chain Finance Solutions with Financial Service Provider's Financial Performance

Observing how financial risk (FR) mediates the link between supply chain finance and financial service provider financial performance as measured by return on assets (ROA). The results are shown below for panel data fixed effect using equations (19), (21), (23) and (25) in the following order. In the first step (path a), a taken mediator as a function of an independent variable. In the second step (path b), a take dependent variable as a function of the mediator, and then (path c), then taken dependent variable as a function of an independent variable to check the conditions of mediation. Lastly, in the last step combined all, the results show both independent and mediator simultaneously test the partial or full mediation of financial risk in a relationship between supply chain finance solutions and financial service provider financial performance measured by return on assets (ROA).

H_2: Financial risk mediates the relationship between supply chain finance and financial service providers' financial performance.

Table 4.6 shows the results of mediating influence of financial risk (FR) in the relationship between supply chain finance and financial service provider financial performance measured by return on assets (ROA) in the pooling of countries. The results demonstrated that in all the paths (a, b, and c), also, both firm- and country-specific control variables were added to the model. Firm-level control variables and country-level control variables are also part of model.

In path-a supply chain finance results are negative insignificant (β= -0.17). Path-b results show that financial service provider financial performance measured as (ROA) and financial risk (FR) affects the ROA negatively (β= -0.0570) at 1% significance level. Therefore, path-b results shows that financial risk FSP financial performance has negative association.

TABLE 4.6: Mediating role of financial risk in a relationship of Supply Chain Finance Solutions Index with Firm Performance

Variables	**Path-a**	**Path-b**	**Path-c**	**All Combine**
Dependent Variables	**FR**	**ROA**	**ROA**	**ROA**
SCFSI	-0.1*		0.074***	0.075***
	-0.273		-1.7289	-1.8372
FR		-0.0570*		-0.0597***
		(-1.8072)		(-2.147)
AA	3.424***	0.725***	0.567***	0.733***
	-2.3642	-1.8798	-2.047	-2.0716
EA	0.364***	0.021**	0.019*	0.037**
	-2.7899	-1.125	-0.726	-1.6367
BS	0.088***	0.004*	0.058*	0.004*
	-7.091	-0.477	-0.992	-0.9343
GDP	0.01	0.044**	0.045**	0.045**
	-0.78	-0.024	-0.02	-1.4823
IR	0.277***	-0.071	-0.087*	-0.072
	-3.7019	-0.144	-0.066	-0.13
ER	0.221	-0.212**	-0.25**	-0.237**
	-0.238	-0.032	-0.01	-0.015
Constant	-3.448***	1.253***	1.623***	1.44***
	(-2.346)	-0.9202	-1.2908	-1.101
No of observation	374	374	374	374
Time effect	Yes	Yes	Yes	Yes
Country effect	Yes	Yes	Yes	Yes
F-statistic	42.682***	28.999***	30.368***	29.921***
Adjusted R2	0.824	0.759	0.768	0.769

*Note: ROA=Return on assets, SCFSI= Supply chain finance solutions index, FR= Financial Risk, AA= Advances to assets ratio, EA= earning assets, BS=Bank size, GDP=Gross domestic product, IR= Interest rate, ER= Exchange rate. * * *P < 0.01, * * P < 0.05, *P < 0.1 Parenthesis= (P-value, significance)*

TABLE 4.7: Mediations (H2)

Hypothesis	**Direct Effect**	**Indirect Effect**
SCFSI → FR → FP	0.075***	0.0097*

In path-c results depict that supply chain finance enhances the financial service providers financial performance (β=0.074) at 10% significance level. Moreover, all the control variables at firm and country level are significant at 1%, 5% and 10%. Hypothesis 2 predicted the mediation effect of financial risk in the relationship of supply chain finance solution index and financial service providers financial performance. the direct and indirect impact effect can be seen inTable 4.7. In first step the direct effect turnout is 0.075 and significant. Second step is to check full or partial meditation. For full mediation to exists direct path has to be insignificant, when indirect path results are significant, direct and indirect path significant shows partial mediation.

In the table 4.6 all paths, a, b, and c are showing significant results therefore, financial risk (FR) mediates the relationship between supply chain finance and financial service provider financial performance (Baron and Kenny, 1986).

In the last all combine effect of Table 4.6, the results show that supply chain finance (β=0.1463) and financial risk (β=-0.0258) both have significant impact on firm performance measured as return on assets (ROA) when considering simultaneously and according to Table 4.7 both direct and indirect path significant. Therefore, financial risk partially mediates the relationship between supply chain finance and financial service provider financial performance (ROA).

Financial risk as mediator hypothesis acceptance between SCFSI and FSPP highlight the critical side of overall SCF impact on performance of financial service provider. This suggest that SCF has the potential to enhance the return of assets finance provider performance and financial risk effectiveness is highly related to involved risk-level. How well banks capitalize the SCFS benefits is depend upon on banks ability to mitigate and manage financial risk.

When FR is high, it shows a positive impact of SCFS on return on assets, as evidenced by negative relationship between FR and ROA in path-b. This shows that robust risk-management strategies importance for finance providers who ae

engage in SCF program. If the mange effective risk like critical evaluate the non-performing loans and capital adequacy ratio can improve profit and SCF activities sustainability, despite the inherent risk.

Moreover, financial risk mediation analysis shows FR present, still have positive impact of return on assets path-c. however, partial mediation of financial risk shows that it has significant role, results shows that SCFS retain positive direct impact performance. Reducing financial risk amplify the SCF benefits on banks bottom line.

All these paths consistently indicate that financial risk mediates the relationship between supply chain finance and firm performance. The findings align with existing literature, suggesting that when banks offer new solutions like supply chain finance, it impacts firm performance and influences the risk levels for financial service providers. According to information processing theory, the asymmetry of information increases financial risk, but supply chain finance mitigates this risk by reducing uncertainty.

Supply chain finance enables financial service providers to better evaluate small businesses and improve financial performance by reducing financial risk (Moretto et al., 2019). Thus, when financial service providers offer supply chain finance, financial risk decreases, and financial performance improves. This supports the acceptance of H2: Financial risk mediates the relationship between supply chain finance and financial service providers' financial performance.

Furthermore, firm and country-level control variables were used to avoid bias in investigating the impact of supply chain finance on financial performance, considering the moderating role of financial visibility and growth and the mediating role of financial risk. Firm-level control variables showed mixed results, both negative and positive, consistent with the literature.

Firm size significantly impacts firm performance, although some businesses may perform poorly despite growth. Earning assets have a positive impact on firm performance (Munjal et al., 2019). The bank size has a significant positive impact on financial performance (Irawati et al., 2019). The advances to assets ratio significantly impacts firm performance (Nugraha et al., 2021); (Prabowo et al., 2018).

There is a positive relationship between GDP and firm performance. Interest rates positively relate to firm financial performance (Hussain et al. 2021). Exchange rates significantly impact firm financial performance. These findings provide a comprehensive understanding of the factors influencing the financial performance of financial service providers and the importance of supply chain finance in mitigating financial risk and enhancing performance.

Finally, from all the above, the conclusion, **H_2: Financial risk mediates the relationship between supply chain finance and financial service providers financial performance is accepted.**

4.7 Moderating role of financial visibility in the relationship between Supply Chain Financial Solutions Index and Financial Service Provider's Financial Performance

The moderating role of financial visibility in the relationship between supply chain finance and financial service provider financial performance measured by return on assets are reported in Table 4.8 by using equation (27).

H_3: Financial visibility moderators the relationship between supply chain finance and financial service provider financial performance, such that the relationship between supply chain finance solutions moderates with financial service provider financial performance when financial visibility is high.

Model-I show result with supply chain finance solution index effect, model-II shows result with supply chain finance solution index and financial visibility and model-III shows results with supply chain finance solution index, financial visibility and interaction term moderating role of financial visibility on the relationship of supply chain finance solutions index.

Table 4.8 panel data results show that in model-II financial visibility has a coefficient of 0.157with significant value. 0.459. In model-III interaction term moderating

role of financial visibility shows significant positive effect 0.026. Each1 unit change in supply chain finance solutions index has 0.025 units change in return on assets with moderating role of financial visibility.

In both models I, II and III, control variables also have significant impact on the relationship of supply chain finance solution index and firm performance with moderating role of financial visibility. Loan to assets ratio, earning assets and bank size used as bank-level control variables and has positive significant impact on the relationship of supply chain finance solution index and firm performance. Country-level control variable GDP has positive significant impact, 1 percent increase in GDP has increase 0.064, 0.068 and 0.044 percent point in return on assets respectively in model-I, II and III. I unit increase in interest rate, return on assets has decrease 0.108, 0.095 and 0.08 units respectively model-I, II and III. Further 1 percent increase in exchange rate will decrease 0.115, 0.09 and 0.194 percentage points in return on assets respectively in model-I, II and III.

Hypothesis H3 is accepted. This suggests that financial visibility moderate the relationship between supply chain finance and financial service provider performance, meaning that the relationship between supply chain finance and financial performance is influenced by financial visibility.

This shows that SCFS impact on banks performance is not uniform across all the context other then it has significant influence with the financial visibility level which a bank possess. Financial visibility is the accessibility and clarity of information within the SC. When investor can get information from stock price return information their investment decision will affect the financial performance of banks.

High financial visibility they can take informed decision about the new innovational financing ways like supply chain finance and able them to better assess risk and finance provider can optimize the fund and quickly respond to the market changes. The informed decision-making ability strengthen the positive impact of SCFSI on return on assets because they can better balance risk and return.

On the other side if financial visibility is low, the SCF benefits maybe diminished. Investor and finance providers may face struggle to know about the financial health.

Few studies exist on the relationship between supply chain finance and financial visibility. High financial visibility benefits shareholders and positively affects firm performance. Financial visibility enhances financial service provider performance with high visibility (Nose [105]) and impacts market knowledge, influencing supply chain finance solutions offerings. However, the link between visibility and business performance may be more complex than expected.

According to information processing theory, financial service providers need more visible information. In supply chain finance, information on debt, transaction costs, liabilities management, and external market, technology, political, and environmental factors affect business performance. Financial service providers aim for wealth maximization and market growth, requiring visible information to improve performance and control costs.

Therefore, hypothesis H3 is accepted, where financial visibility moderates the relationship between supply chain finance and financial service provider performance.

4.8 Moderating role of firm growth as a Moderator in a relationship between supply chain finance solutions index and financial service provider's financial performance

Firm growth has the potential to moderate the relationship between the Supply Chain Finance Solutions Index (SCFSI) and the financial performance of financial service providers, as measured by return on assets (ROA). This potential moderating influence was investigated using a fixed effect model. The empirical findings are detailed in Table 4.8, which shows how firm growth moderates the link between SCFSI and financial performance (ROA) in panel data by using equation (30)

H_4: Firm Growth moderates the relationship between supply chain finance and financial service provider financial performance such that the relationship between supply chain finance solutions and financial

TABLE 4.8: Moderating role of Financial Visibility in a relationship of Supply Chain Finance Solution Index with Firm Performance

Variables	**Model-I**	**Model-II**	**Model-III**
SCFSI	0.077*	0.079***	0.06717***
	-1.8757	**-4.121**	-3.4952
FV		0.157**	0.158**
		-2.977	-3.1019
FV*SCFSI			0.026*
			-1.8431
AA	0.633**	0.601**	0.557**
	-2.244	-3.169	-2.9739
EA	0.035**	0.036*	0.005*
	-2.1016	-0.664	-0.0966
BS	0.001	0.001	-0.001
	-0.5024	-0.223	(-0.1651)
GDP	0.064	0.068***	0.044**
	-1.8017	-3.363	-2.2952
IR	-0.108	-0.095	-0.08
	(-1.1851)	-1.945)	(-1.6025)
ER	-0.115	-0.09	-0.194
	(-0.5481)	(-0.611)	-1.9754
Intercept	1.4778	0.6839	1.2189
	-1.1797	-0.9909	-2.6114
No of observation	374	374	374
Time effect	Yes	Yes	Yes
Country effect	Yes	Yes	Yes
F-statistic	31.403***	25.8500***	30.9730***
Adjusted R2	0.767		0.7714

*Note: ROA=Return on assets, SCFSI= Supply chain finance solutions index, FV=Financial Visibility, FV*SCFSI= Interaction term, AA= Advances to assets ratio, EA= earning assets, BS=Bank size, GDP=Gross domestic product, IR= Interest rate, ER= Exchange rate. * * *P < 0.01, * * P < 0.05, *P < 0.1 Parenthesis= (P-value, significance)*

service provider financial performance is stronger when firm growth is high.

In the panel data model-II, the direct impact of firm growth on financial service providers' financial performance shows a positive significant coefficient 0.109, and the interaction term also shows positive significant results. This suggests that firm growth moderate the relationship between SCFSI and ROA. The adjusted R-squared is 0.76, indicating that 76% of the variation in financial service providers' financial performance is explained by the model. This indicates that while SCFSI plays an important role in financial performance, firm growth moderates this relationship.

In both models I, II and III, control variables also have significant impact on the relationship of supply chain finance solution index and firm performance with moderating role of firm growth. Loan to assets ratio, earning assets and bank size used as bank-level control variables and has positive significant impact on the relationship of supply chain finance solution index and firm performance. Country-level control variable GDP has positive significant impact, 1 percent increase in log GDP has increase 0.064, 0.048 and 0.049 percent point in return on assets respectively in model-I, II and III respectively. I unit increase in interest rate, return on assets has decrease 0.108, 0.73 and 0.08 units respectively model-I, II and III. Further 1 percent increase in exchange rate will decrease 0.115, 0.348 and 0.2474 percentage points in return on assets respectively in model-I, II and III.

Table 4.9: Moderating role of Firm Growth in a relationship of Supply Chain Finance Solution Index with Firm Performance

Variables	**Model-I**	**Model-II**	**Model-III**
SCFSI	0.077*	0.067***	0.06717***
	-1.8757	-3.7956	-3.4952
GR		0.109***	0.048**
		(-3.9136)	(-1.4377)
GR*SCFSI			0.006**
			-0.5056
AA	0.633**	0.131*	0.772***
	-2.244	-0.6844	-3.4941
EA	0.035**	0.106**	0.053
	-2.1016	-2.0581	-0.799
BS	0.001	0.009*	0.002
	-0.5024	-1.6301	-0.347
GDP	0.064	0.048**	0.049**
	-1.8017	-3.0153	-2.4566
IR	-0.108	-0.073*	-0.08
	(-1.1851)	(-1.832)	(-1.6778)
ER	-0.115	-0.348***	-0.2474
	(-0.5481)	(-4.3022)	-2.4932
Intercept	1.4778	1.7051	1.3697
	-1.1797	-4.405	-2.5389
No of observation	374	374	374
Time effect	Yes	Yes	Yes
Country effect	Yes	Yes	Yes
F-statistic	31.403***	30.2315***	30.0601***
Adjusted R2	0.767	0.739	0.7659

*Note: ROA=Return on assets, SCFSI= Supply chain finance solutions index, GR=Firm Growth, GR*SCFSI= Interaction term, AA= advances to assets ratio, EA= earning assets, BS=Bank size, GDP=Gross domestic product, IR= Interest rate, ER= Exchange rate. * * *P < 0.01, * * P < 0.05, *P < 0.1 Parenthesis= (P-value, significance)*

From the discussion of Table 4.9, it is evident that firm growth moderates the relationship between SCFSI and the financial performance of financial service providers in several countries. According to signalling theory, asymmetry of information exists between finance providers and suppliers/buyers, and finance providers can improve firm growth by signalling to mitigate this asymmetry and increase firm performance. The results are consistent with literature and theory, showing that firm growth moderates the relationship between SCFSI and financial service providers' financial performance.

In conclusion, **hypothesis H4 is accepted, firm growth moderates the relationship between SCFSI and financial service provider performance.**

4.9 Robustness of Results

In this study, robustness tests were applied to assess potential endogeneity issues, ensuring the reliability and validity of the findings. The results were found to be consistent with previous outcomes, reinforcing their robustness.

To further validate the results, the Generalized Method of Moments (GMM) technique was employed. This method was used to test the impact of the Supply Chain Finance Solutions Index (SCFSI) on the financial performance of financial service providers. The GMM technique also examined the moderating roles of financial visibility and firm growth, as well as the mediating role of financial risk in the relationship between SCFSI and financial service providers' financial performance.

The application of the GMM technique confirmed that the results were robust across different contexts and models. The findings regarding the direct impact of SCFSI, the moderating effects of financial visibility and firm growth, and the mediating role of financial risk remained consistent, indicating that the relationships identified in the study are stable and reliable. This comprehensive approach to robustness testing ensures that the conclusions drawn from the study are well-supported and credible.

The first step is used to check the endogeneity test for panel data. Following the literature [149][154], the Durbin-Wu test was applied to confirm the presence of endogeneity in the model's explanatory variables. The first step involved regressing a lag value of the dependent variable, return on assets (ROA), on all other independent and control variables for panel data. Residual terms were obtained from this regression. In the second step, the residual terms (Resid) were incorporated as independent variables along with all other independent and control variables for panel data. The significance of the Resid coefficients at 1Pooled data, the residual term (Resid) was regressed on all independent and control variables. The significant coefficients confirmed the presence of endogeneity in the research models. Consequently, the Generalized Method of Moments (GMM) was applied to test the research hypotheses. In the models endogeneity identifications highlight the critical need to use the robust analytical technique. This endogeneity can lead

towards the biased estimation and misleading which will at the end effect the final conclusion for policy implications and decision-making. By estimating results with countries facing endogeneity problem with GMM technique, results ensure that more accurate variables relationship and enhance the study reliability. The next section will explore the chose between use of system or difference GMM technique.

4.9.1 Selection between System GMM and Difference GMM

After confirming the endogeneity, the choice between system GMM and difference GMM was considered. According to Blundell and Bond (1998),if the lagged value is titled toward 1 of dependent variable, indicating that the DV is close x cand show a random walk, the difference GMM estimation becomes inefficient. This is occurred due to difference GMM results riles on 1st difference data, which can take valuable information out in the persistent of depended variable. As the results using of system GMM is more reliable estimation, which there is weak instruments and possibility of biasness which is present in different GMM.

To choose between system GMM and difference GMM, the initial dynamic model was estimated through Pooled OLS and FE models. Through Pooled OLS, the coefficient of the lagged DV provides an upper limit, and the lower limit for the coefficient is estimated through the FE model. This methodology allowed that a clear estimation effect over different model specifications. The third step involves difference results estimation, comparing these results with the first two. If the lagged DV coefficient from difference GMM is closer to the FE model estimation, this indicates weak instrumentation and downward biasness of the former estimation. In such cases, the system GMM estimator is used. In such cases, the system GMM estimator is used. This study chose between difference GMM and system GMM following the guidance from (Bond et al., 2001).

Table 4.10 lagged DV coefficient values shows the comparison between Pooled OLS and FE model and Difference GMM to choose system or difference GMM. Pooled OLS coefficient is considered as upper limit and coefficient of FE model as lower limit. If difference GMM lagged DV coefficient value is above or near to Pooled OLS lagged DV then difference GMM should be preferred on the other side if the

TABLE 4.10: DV Lagged Coefficient to choose between System GMM and Difference GMM

		ROA
SCF	Pooled OLS	.456***
	Fixed Effect	.326**
	Difference GMM	.288**

**** P<.01, ** P<.05, * P<.1*

value of difference GMM lagged DV coefficient value is below or near to FE model lagged DV then system GMM should be preferred. On the evident of Table 4.10 the system GMM technique is preferred for estimation.

4.9.2 System GMM Results

The primary analysis used in this research in fixed-effect model, which address the unobserved heterogeneity and also control for time-invariant characteristics. To further confirm the availability of results system GMM was employed. In Table 4.11, the results obtained by with system GMM show that financial service provider financial performance measured by return on assets, reveals the supply chain finance solution index has statistically significant impact on financial service provider financial performance.

The following results by using equations (20), (22), (24) and (26) in the following order of mediating influence of financial risk (FR) in the relationship between supply chain finance and financial service provider financial performance measured by return on assets (ROA). The results demonstrated that in all the paths (a, b and c) by applying system GMM, the autoregressive terms AR (1) and AR (2) were used to address the autocorrelation issued and at AR (2) this autocorrelation issue resolved. Moreover, Hansen J-Statistic are showing the validation of instrumental overidentifying restrictions. Also, both firm and country specific control variables were added in the model. Firm-level control variables and country-level control variables are also part of model.

In path-a, Table 4.12 supply chain finance results are negative significant at 5% level (β= -0.1913). Based on the statistical results, the results show that supply

chain finance has negative significant relationship with finance risk,higher use of supply chain finance solutions are associated with financial risk. This is aligned with pervious results and literature that supply chain finance is intended to improve the operational efficiency; it can also tiger the financial risk of finance provider. Based on the statistical results, the results show that supply chain finance has negative significant relationship with finance risk.

Path-b results show that financial service provider financial performance measured as (ROA) and financial risk (FR) affects the ROA negatively (β= -0.1656) at 1% significance level. Therefore, path-b results concluded that there is negative association between financial risk and financial service provider financial performance measured as return on assets (ROA).

In path-c results show that supply chain finance enhances the financial service provider's financial performance (β=0.1475) at 1% significance level. Moreover, all the control variables at firm and country level are significant at 1%, 5% and 10%. So, there is a significant relationship between supply chain finance and financial service provider financial performance.

In the last, all combine effect, the results show that supply chain finance (β=0.1463, P=0.0489) and financial risk (β=-0.0528, P=0.0586) both have significant impact on return on assets (ROA) when considering simultaneously; therefore, financial risk partially mediates the relationship between supply chain finance and financial service provider financial performance (ROA).

The finding in Table 4.12 shows that supply chain finance solutions are significant to enhance the finance provider performance, further highlight the financial risk as mediator factor in this relationship. Aligned with pervious results and literature financial risk information is providing guideline to policy implications and practical applications along guideline to finance provider to navigate the complex supply chain finance into dynamic to manage the risk.

TABLE 4.11: Impact of Supply Chain Finance Solutions Index on Financial Service Providers' Financial Performance by Employing GMM

Variables	**Panel**
ROA (-1)	-2.165
	(0.1666)
SCFSI	1.54*
	(1.067)
AA	-0.6571
	(0.8163)
EA	0.0815**
	(0.0171)
BS	0.0024***
	(0.1069)
GDP	0.0083
	(0.1289)
IR	0.6194
	(1.1753)
ER	-0.2269
	(0.0928)
Constant	0.6155
	(0.3284)
AR (2)	-0.78085
	(2.6571)
Hansen J-Stat P-Value	0.04668
	(0.9999)

*Note: ROA=Return on assets, SCFSI= Supply chain finance solutions index, AA= Advances to assets ratio, EA= Earning assets, BS=Bank size, GDP=Gross domestic product, IR= Interest rate, ER= Exchange rate. ***P < 0.01, **P < 0.05, *P < 0.1. Parenthesis = (P-value, significance)*

TABLE 4.12: Mediating role of financial risk in a relationship of Supply Chain Finance Solution Index with Firm Performanceby Employing GMM

Variables	**Path-a**	**Path-b**	**Path-c**	**All Combine**
Dependent Variables	**FR**	**ROA**	**ROA**	**ROA**
DV (-1)	-0.0906	0.0644	0.3932	0.3938
	(0.5233)	(0.6354)	(0.0043)	(0.0117)
SCFSI	-0.1913**		0.1475**	0.1463**
	(0.0275)		(0.0188)	(0.0146)
FR		-0.1656*		-0.0258*
		(0.0555)		(0.0618)
BS		0.0094*	-0.0019*	0.0025*
		(0.0531)	(0.0635)	(0.0976)
EA		0.0179*	0.1547**	0.1430*
		(0.0818)	(0.0104)	(0.0896)
LA		-0.0578*	-0.2335**	-0.1929*
		(0.0856)	(0.0258)	(0.0874)
T1		6.7800**	-3.1905**	-3.2769*
		(0.0434)	(0.0205)	(0.0766)
TCA		2.8016*	0.7959**	0.8744**
		(0.0682)	(0.0528)	(0.0156)
GDP		0.0039**	0.0565*	0.0441*
		(0.0191)	(0.0576)	(0.0569)
IR		-0.1762**	-0.1491*	-0.1443
		(0.0334)	(0.0683)	(0.0806)
ER		-0.2761**	-0.2205*	-0.2029*
		(0.0325)	(0.0804)	(0.0757)
Constant	-1.8163	1.0575	1.4254	0.1463
	(0.0698)	(0.4468)	(0.0374)	(0.019)
AR (1)	0.4087***	0.1599*	-0.2840*	-0.2832
	(0.0000)	(0.0728)	(0.074)	(0.0817)

AR (2)	-0.1046	0.1258	-0.2232	-0.2178
	(0.175)	(0.3629)	(0.2987)	(0.344)
No. of Instruments	272	272	272	272
Hansen J-Stat	3.2187	1.3531	1.7111	1.7501
P-Value	(0.9550)	(1.0000)	(1.0000)	(1.0000)

*Note: ROA=Return on assets, SCFSI= Supply chain finance solutions index, FV= Financial visibility, FV*SCFSI = Interaction term, T1=Tier-1 Capital ratio, TCA= tier 1 capital ratio, BS=Bank size, EA= earning assets, LA= loan to assets ratio, ER= Exchange rate, GDP=Gross domestic product, IR= Interest rate.* $***P < 0.01$, $**P < 0.05$, $*P < 0.1$ *Parenthesis= (P-value, significance)*

In Table 4.13, equation (28), shows the moderating role of financial visibility in the relationship of supply chain finance solutions index and performance of finance providers through system GMM. The finding indicates that the coefficient of supply chain finance solution is positive with significant value (β=0.2673, P=0.0963) at 1% level.

Ffinancial visibility, the direct effect on the financial performance of the financial service provider coefficient is 0.1069 with significant p-value, showing that in the pooling of these countries the financial visibility contribution is collective for the finance providers.

Moreover, the interaction term moderating role of financial visibility and SCFSI shows a positive coefficient for all context, with pool of data positive coefficient (0.0171) at 1% significance level. This suggest that financial visibility moderates the relationship between supply chain finance solutions index and performance of finance providers

The direct impact of firm growth on the financial service provider's financial performance is in Table 4.14, equation (31), the firm growth direct effect coefficient is 0.0572 with significant p-value (0.0641) and moderating role of firm growth in the relationship between supply chain finance and financial service provider financial performance coefficient is 0.0454 with significant p-value (0.0002).

TABLE 4.13: Moderating role of Financial Visibility in a relationship of Supply Chain Finance Solution Index with Firm Performance by employing GMM

Variables	**Panel**
ROA (-1)	0.2846
	(0.1666)
SCFSI	0.2673*
	(0.67)
FV	0.1069*
	(0.740)
FV*SCFSI	0.0171*
	(0.619)
AA	1.1753
	(0.2097)
EA	0.3864
	(0.4358)
BS	-0.003
	(0.7782)
GDP	0.0928
	(0.4461)
IR	-0.3284
	(0.1989)
ER	-0.3214
	(0.1461)
Constant	2.6571**
	(0.336)
AR (1)	0.0411
	(0.065)
AR (2)	-0.1457
	(0.467)
No. of Instruments	272
Hansen J-Stat P-Value	0.9825
	(0.9999)

*Note: ROA=Return on assets, SCFSI= Supply chain finance solutions index, FV= Financial visibility, FV*SCFSI = Interaction term, AA= Advances to assets ratio, EA= earning assets, BS=Bank size, GDP=Gross domestic product, IR= Interest rate, ER= Exchange rate. * * *P < 0.01, * * P < 0.05, *P < 0.1 Parenthesis= (P-value, significance)*

TABLE 4.14: Moderating Role of Firm Growth in the Relationship of Supply Chain Finance Solution Index with Firm Performance by Employing GMM

Variables	**Panel**
ROA (-1)	0.42542***
	(1.321)
SCFSI	0.16435**
	(0.414)
GR	0.0572**
	(0.0296)
GR*SCFSI	0.0454**
	(0.281)
AA	0.5936*
	(0.621)
EA	0.1730***
	(0.183)
BS	0.0079
	(0.2836)
GDP	0.0303
	(0.7495)
IR	-0.1184
	(0.3674)
ER	-0.127
	(0.2624)
Constant	0.8832
	(0.0548)
AR (1)	-0.3021**
	(0.0513)
AR (2)	-0.276
	(0.2219)
No. of Instruments	272
Hansen J-Stat P-Value	1.9786
	(0.0091)

*Note: ROA=Return on assets, SCFSI= Supply chain finance solutions index, GR= Firm Growth, GR*SCFSI = Interaction term, AA= Advances to assets ratio, EA= earning assets, BS=Bank size, GDP=Gross domestic product, IR= Interest rate, ER= Exchange rate. ***P < 0.01, **P < 0.05, *P < 0.1 Parenthesis= (P-value, significance)*

Financial visibility moderates the relationship of supply chain finance and financial service provider financial performance, in the robust analysis they relationship also align with main finding of fixed effect mode. Firrm growth has a significant moderation effect in the relationship between supply chain finance solution index

and finance service provider financial performance at a 1% significant level in the panel data.

4.10 Chapter Summery

This chapter presented the detail empirical analysis of sample data by employing fixed-effect model and robustness test system GMM. First check the descriptive results of the data along with correlation analysis. Data stationarity test is also applied; to select between random and fixed effect model Husman test applied and fixed-effect model is used to test the hypothesis. In the robustness analysis system GMM test applied to confirm the validity of the data results.

4.11 Tested Hypotheses:

Table 4.15: Tested Hypotheses Summary

	Hypotheses	**ROA**
H_1	Supply chain finance solutions have a positive impact on financial service provider financial performance.	Accepted
H_2	Financial risk mediates the relationship between supply chain finance and financial service provider financial performance.	Partial Mediation Accepted
H_3	Financial visibility moderators the relationship between supply chain finance and financial service provider financial performance, such that the relationship between supply chain finance solutions moderates with financial service provider financial performance when financial visibility is high.	Accepted
H_4	Firm Growth moderates the relationship between supply chain finance and financial service provider financial performance such that the relationship between supply chain finance solutions moderates and financial service provider financial performance is strong when firm growth is high.	Accepted

Chapter 5

Conclusion and Recommendations

This chapter discussed the conclusion of the study's research objectives, the details of the implications, the study's limitations, and the future directions.

5.1 Conclusion

The study finding unequivocally provide the supply chain finance solution transformative power to enhance the financial service provider financial performance and it is an essential component to enable banks to navigate the complex supply chain finance solutions into dynamics and with mitigation of financial risk; financial visibility amplifying banks growth.

The study's main objectives are to capture the impact of supply chain finance on financial service provider financial performance and to highlight the mediating role of financial risk, moderating role of financialand firm growth. Thoroughly studying the theoretical and past studies, this study also established the conceptual framework along with study hypotheses.

Return of asset was used as a financial service provider's financial performance measurement. First, the study aimed to construct a supply chain finance index using all available supply chain solutions. supply chain finance was measured by supply chain finance solution index, which is calculated by using different supply

chain finance solutions through principal component analysis (PCA). The created index is used as an independent variable supply chain finance solutions index and regressed with financial service provider financial performance.

The financial risk has been measured by considering credit risk and non-performing loans. Firstly, credit risk and non-performing loans were calculated through principal component analysis. The financial risk was calculated and used as mediator in the study.

Financial visibility was measured by taking stock price return, which was used as a moderator in the study.

Moreover, firm growth has also been measured by taking assets, profit, and loan growth over the year. Principal component analysis combined all growths (assets, loan and profit) as on firm growth variable to capture the study's moderating effect.

The conceptual framework and hypothesis have been tested for all the Asian Development Bank registered countries and banks with a supply chain finance program.Selection of supply chain finance is due to new and innovative concept introduced to facilitate developing countries' banks and trade activities.

Traditional trade credit is difficult and riskier for finance providers, whereas supply chain finance reduces the risk level and disruption in the supply chain for all involved parties, whether providers or takers. According to the Asian Development Bank, the supply chain finance program aims to reduce the finance gaps between small and medium enterprises and help them become part of the global trading system. This program aims to support and provide finance to registered banks, thereby improving the cash flow from financial service providers to different companies.

Therefore, the study selected 35 banks from 8 countries registered with the Asian Development Bank to test the hypotheses.The annual data was collected from 2012 to 2022, covering a time frame of 11 years. In the data analysis first descriptive statistics and correlation analysis test applied. The conceptual framework and hypotheses were further tested using a fixed effects model, and a robustness test was applied to check for endogeneity issues using the system generalized method of moments (GMM). For hypotheses testing, firm-level control variables (advances to

assets ratio, earning assets, bank size) and country-level macroeconomic control variables (gross domestic product, interest rate, exchange rate) were used.

5.2 Main finding of the study

The main objectives of the study are as follows: to align with research questions and establish hypotheses.

1. To study the impact of supply chain finance solutions on the financial service provider's financial performance
2. To analyze the mediating role of financial risk between supply chain finance solutions and financial service providers' financial performance
3. To analyze the moderating role of financial visibility on the relationship of supply chain finance solutions and financial service provider's financial performance
4. 4. To analyze the moderating role of growth on the relationship of supply chain finance solutions and financial service provider's financial performance.

These objectives and hypotheses of the study have been established and tested using a fixed effects model and robustness tests with the system GMM. The main findings of the study were obtained from data. These findings explain the status of the hypotheses and further demonstrate the achievement of the study's objectives.

5.2.1 Impact of Supply Chain Finance on Financial Service Providers Financial Performance

The analysis has been conducted in the context of all registered Asian Development Banks with supply chain programs. The results indicate that supply chain finance positively impacts the financial performance of financial service providers, as measured by return on assets.

Therefore, it is concluded that hypothesis H1: supply chain finance solutions have a significant positive impact on firm performance measured by return on assets is

accepted. According to past studies, supply chain finance positively impacts firm performance (Beka Be Nguema et al., 2022). Signaling theory suggests that the supply chain finance program is a growth signal from financial service providers and impacts financial performance (Song et al., 2023)."

5.2.2 Mediating Role of Financial Risk in the relationship between Supply Chain FinanceSolutions and Financial Service Provider Financial performance.

Financial risk is critically emerging as mediator, with banks offering supply chain finance solutions alleviating risk and enhance financial service provider financial performance. Financial risk of banks reduces by offering supply chain finance over traditional trade credit.

The results demonstrate that for all the registered banks with the Asian Development Bank under the supply chain finance program, financial risk plays a mediating role between supply chain finance and the financial performance of financial service providers, as measured by return on assets (ROA).

In the panel data set financial risk partial mediates the relationship between supply chain finance and financial service provider financial performance measured as return on assets. Furthermore, the study results shows that supply chain finance solution offered by banks is linked with enhanced with risk management and better FSP financial performance.

Therefore, it is concluded that hypothesis H2: Financial risk has a mediation role between supply chain finance solutions and financial service provider financial performance is accepted. This fulfils the study's objective of analyzing the mediating role of financial risk between supply chain finance solutions and the financial performance of financial service providers.

The results are consistent with the mediating procedure of variables in the relationship between dependent and independent variables (Baron and Kenny, 1986; Khan et al., 2021). According to the literature, risk is crucial for firm performance and ultimately affects firm growth (Manhart et al., 2020). Firms strive for risk mitigation, handle disruptions, and enhance financial performance (Munir et al., 2020).

Therefore, the results are consistent with the literature, showing that financial risk plays a mediating role in the relationship between supply chain finance and firm performance.

5.2.3 Moderating Role of Financial Visibility in the relationship between Supply Chain Finance Solutions and Financial Service Provider Financial performance.

Financial visibility moderates the supply chain finance solutions relationship with financial service provider financial performance as transparency increase the growth benefits and performance. financial visibility strengthens the impact of SCFS on FSP performance.

The results show that financial visibility strengthens relationship between supply chain finance and the financial performance of financial service providers. The greater the financial visibility, the higher the chances of improving the relationship between supply chain finance and firm performance. Financial service providers with higher financial visibility have a more significant impact on performance and reduced risk levels.

The Asian Development Bank reported that Pakistan's SCF market is gradually growing. With high financial visibility, these registered banks significantly and positively impact firm performance. Simply registering with the Asian Development Bank for the supply chain finance program is not the goal of any bank; rather, having proper financial visibility will affect financial performance by offering supply chain finance solutions.

According to information processing theory, financial service providers require more visible information to reduce risk levels (Galbraith, 1974). Finally, it is concluded that H3: financial visibility improves the relationship between supply chain finance and financial service provider financial performance is accepted.

5.2.4 Moderating Role of Firm Growth in the relationship between Supply Chain Finance Solutions and Financial Service Provider Financial performance.

Firm growth is important and, ultimately, the lifeblood of any business. In this study, firm growth plays a significant role in the relationship between supply chain finance solutions and financial service providers' financial performance. When any bank starts a new way to finance the market, its main objective is long-run business growth. With this intention, all registered banks in the supply chain finance program significantly impact firm performance.

Both information processing theory and signaling theory fit well with firm growth in the relationship between supply chain finance and financial service providers' financial performance. Both theories help explain the information and growth of the business. According to signaling theory, when there is information asymmetry, one party gives signals to mitigate it. Brigham et al. Brigham and Houston (2006) explained that signaling theory provides investors with information regarding performance and growth direction based on financial service providers' behavior. When a business gives a growth signal, it enjoys significant positive financial performance.

Furthermore, the objective of the study was to analyze the moderating role of growth on the relationship between supply chain finance and financial service providers' financial performance. Hypothesis H4 states that firm growth significantly affects the relationship between supply chain finance and financial service providers' financial performance.

5.3 Recommendations and Policy Implications

The finding of the study lies in its theoretical, empirical and practical exploration of supply chain finance solutions and their impact on financial service providers financial performance. Specifically, examines the mediating role of financial risk and the moderating effects of financial visibility and firm growth among banks

participating in the Asian Development supply chain finance program. This research opens avenues for further studies on supply chain finance, highlighting its benefits for providers and its positive influence on firm performance.

The supply chain finance program is a growth signal from financial service providers and impacts financial performance. according to Asian development bank annual report 2024, Pakistani banks is highest in number 376.5 billion to offer supply chain finance solution with 9.0 market share on average over 3-5 years. Banks specifically state banks of Pakistan use these results in banks financing policy to implement in the policies and designing the financial options related to supply chain finance to achieve more financial service provider financial performance. Policy makers use these results to formulate the supply chain finance strategies to optimize the financial performance of financial service providers through such targeted financing programs.

Supply chain finance solutions offered with the intension to mitigate the risk level, but how this financial risk can affect the banks financial performance can uplift this concept by this study results. Supply chain finance solution implementation is use and risk mitigation technique and improve financial service provider financial performance especially in those regions where traditional trade credit is challenge.

The study underscores the importance of financial visibility in enhancing performance and growth, mainly in mitigating financial risks within these countries. The findings emphasize practical implications, suggesting guidelines for investors. Financial visibility prioritization strategy uses as wealth maximization through enhanced financial service provider financial performance Specifically, the study recommends that supply chain finance programs aimed at financing and promoting firm growth are essential for improving financial service provider performance. It advocates for banks to sustain these financing initiatives to bolster overall firm performance, especially in regions where traditional trade credit is challenging and bank risk levels are elevated.

Lastly, the study emphasizes that merely registering with the Asian Development supply chain finance program is insufficient; thorough analysis and strategic implementation are crucial to fully capitalize on its benefits.

5.4 Limitations of the Study

The study examined registered countries banks with the Asian Development Bank's supply chain finance program, exploring the mediating role of financial risk and the moderating roles of financial visibility and firm growth. Despite the efforts made, there are opportunities for further contributions in future research. Several limitations were identified in this study.

Firstly, it focused exclusively on registered countries banks with the Asian Development Bank's supply chain finance program. Secondly, it utilized a single proxy for financial visibility (stock price volatility)moderator on the relationship between supply chain finance and financial performance of financial service provider.Thirdly, this study measured internal financial performance solely by return on assets (ROA).

5.5 Future Directions

The identified limitations suggest avenues for future research to broaden its scope by including banks from diverse regions, refining the supply chain finance index methodology, incorporating additional indicators of financial visibility, and exploring diverse metrics to assess financial performance.

Future studies could compare countries and banks that offering supply chain finance programs with those banks which are using traditional trade finance program. with those that do not. Additionally, research could focus on assessing the impact of individual supply chain finance solutions on financial service providers' performance. Comparative studies between banks in developing and non-developed countries regarding their financial performance with supply chain finance could provide valuable insights.

Moreover, future research could compare different supply chain solutions and their respective impacts on firm performance. There is also potential for studies specifically examining the impact of supply chain finance programs on supplier financial performance.

In the future, researchers could investigate the moderating role of financial visibility in the relationship between financial risk and firm performance. Additionally, firm performance can measured with market-base variable like Tobins Q as an alternative perspectives in future studies.

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Appendix

Annexure-I

List of Supply Chain Finance Solutions

Sr. No	SCFS
1	Reverse Factoring
2	Accounts Receivables Financing
3	Purchase Order Financing
4	Agricultural Supply Chain Finance
5	Factoring
6	Online SCF Platform
7	Inventory Financing
8	Warehousing Financing
9	Buyer Direct Financing
10	Vendor-Managed Inventory
11	Raw Material Financing
12	Third Party Logistics Financing
13	Dynamic Discounting
14	Early Payment Discount Program
15	Buy Back Guarantee
16	Credit Guarantee
17	Bank Guarantee
18	Manufacturer Collateral
19	Supplier's Subsidy
20	Pre-selling
21	Trade Credit