

## CAN DIVERSIFICATION MITIGATE CREDIT RISK IN MICROFINANCE INDUSTRY? A CROSS COUNTRY ANALYSIS

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### ABSTRACT

This paper investigates the credit risk with respect to diversification. After banking sector, this study has extended the discussion from banking to microfinance institutions (MFIs) having dual objective of both financial and social nature to eradicate poverty. Risk is measured with the help of credit risk, z-score and Par30 while diversification is determined with respect to revenue, product, geographical and asset. Cross countries data from Pakistan, India and Bangladesh from south Aisa that is the hub of microfinance, is selected for understanding the scenario.the reason. The sample of 135 MFIs from time period 2012-2019 has determined that more risk comes with more diversification. The approach of generalized method of moment (GMM) is employed for panel data analysis and hypothesis testing. The findings are helpful for practitioner and policy makers to adapt strategies of diversification for sustainability of MFIs. Further MFIs can mitigate their risk with the help of strategy of group lending.

**Key Words:** Diversification, Credit risk, Microfinance, GMM, cross country

### INTRODUCTION

There is enormous rise in the number of microfinance institutions (MFIs) after 1997 of about 200 times. The total number of people benefited from microfinance credit are about 120 million (of them women are about 86 percent) (Convergences, 2017). The estimated number of microfinance institutions around the globe is about 10,000 but as per the data provided by MIX market, world bank database, around 800 MFIs serves about 90m borrowers.

According to World Bank statistics, there are about 768 million poor people around the globe and 43% of them is still deprived of access to financial. (World Bank, 2017). This significant proportion reveals importance of uneven existence of poor in Asian region.

The prime target of MFIs is the poor unbanked people but they have also attracted private

investors (Chikalipah, 2017). A microfinance institution can be a bank, non-bank financial intermediary, cooperative bank, non-profit organization etc. These all generate income through both financial and non-financial services. MFIs meet their financial expenses mainly from international donors, subsidies and loans from other commercial banks, government or NGOs on low interest rate (Al-Azzam, 2019).

Microfinance institutions are different as compared to traditional banks as they have dual objective of providing financial services to the poor clients and profitability as well. This objective can only be achieved when they are sustainable and profitable. So, along with financial access, to be financial sustainable is the recent goal of MFIs services (Hermes & Lensink, 2007). They can achieve this if they charge high

rate of interest on loans but this is not helpful due to demand nature of market. On the other hand, offering finance to more clients can increase their financial access in one way but enhance credit risk too. As a result, their performance and ultimately sustainability comes at stake. Hence, the poor segment cannot be obliged effectively (Hu, 2012).

Since MFIs have dual objective of both social and profit nature so they are different from banking financial institutions. This study has examined the relationship between diversification and risk in Microfinance institutions (MFIs) from three countries Pakistan, India and Bangladesh to do a cross country analysis. The question about the adoption of diversification strategies specially in MFIs is still unclear. Extensive literature has determined that whether diversification increase or decrease risk but there is no consensus in financial institutions specially in case of MFIs. In spite of the importance of diversification, this concept is not tested widely in south Asian MFIs that whether MFIs should diversify or not to mitigate their credit risk. Both diversification and credit risk affect the financial performance of MFIs to meet their social objective of targeting the deprived high risk group of clients. Their loan products are generally collateral free. So, they have more exposure to risk. However, with rapid expansion comes complexity, and the complexity of risk management is critical to the sustainability and impact of microfinance institutions (MFIs) in this evolving environment.

Diversification is considered as the most fundamental concept in portfolio theory. The aim of this concept is to dilute the portfolio overall unsystematic risk with the selection of the most uncorrelated products (Markowitz, 1952). Risk can be financial risk or business risk. Business risk is further categorized as systematic risk and unsystematic system. Diversification reduces only unsystematic risk. There are many other benefits of diversification along with risk minimization i.e., enhance the growth rate and market value of shares, improve the customer base, help to regulate cash flows etc. Thus, more income sources of financial institutions would enable them to offer more financial services and

meet operating expenses efficiently. It would also reduce their risk level. Hence, financial performance in terms of sustainability and profitability will be enhanced (Winton, 1999).

Similar to commercial banks, MFIs also have to follow regulations and supervisions that determine their concentration or diversification decision. Therefore, current study is very attractive for the policy makers, investors, donors, regulators and microfinance practitioner concerned about importance of diversification for financial institutions and MFIs as well.

This study explained the complex relationship between strategic diversification and risk management in cross country context. There are multiple risks in this sector and credit risk is the most important one. By examining the strategic choices and practices of MFIs, the paper seeks to provide valuable insights into the various ways in which they can be used as a means of mitigating risk and improving the resilience of these firms.

As microfinance institutions continue to grow and diversify their portfolios, it is critical to understand the potential benefits and challenges associated with this expansion. In a region as diverse as south Asia, characterized by a wide range of economic, social and cultural conditions, the dynamics of risk and diversification have various dimensions. This study aims to contribute to the ongoing debate on the sustainability of the sector and its ability to enhance financial inclusion and social development by gaining a deeper understanding of the various interconnections of microfinance.

MFIs are in their most developed form in Pakistan and India after Bangladesh, being hub of microfinance. Various government banks and other non-government institutions, credit unions and cooperative societies are providing microfinance services (Microfinance Institutions Network, 2017). Government owned MFIs mainly banks and Non-Bank MFIs, only focused on microcredit products without any emphasis on outreach, with their prime mission of financial sustainability. On the opposite, the objective of NGOs is access to a large number of poor people. NGOs play significant contribution in microfinance sector as large proportion of NGOs

than others like Bangladesh and India. (Fernando, 2000).

### **Background of Microfinance Institutions in Asia**

Asia being the largest continent of the world, consist of 48 countries. It covers one third of total land area of our world. This most complicated land is divided into many regions named as East Asia, South Asia, Central Asia, Middle East, Asia Pacific and Russia as well. It is also observed that six out of ten largest economies of the world also exist in Asia and most of the Asian countries comes under the categories of developing and emerging economies. It demonstrated Asia as a prominent continent of this planet Earth. As far the growth of Asian region is concerned, it showed tremendous rise of 41% in GDP with respect to purchasing power parity from year 2000 to 2018 (Asian Development Bank, 2019).

Asia is also considered as the most populous region of the world after Africa and Europe as more than half about, 58% out of total population of the world resides in Asia. Further, out of total poor population, two third population about 43% are found in Asia (World Bank Poverty Report, 2019). To cope with this poverty, Asian countries have followed various strategies and one of those is Microfinance (Fernando, 2000). The early roots of appearance of microfinance are found in this region during early 1970s. Behind the emergence of need of microfinance from the poor and unbanked segment of people of Asia, was unequal distribution of wealth. So, this sector flourished rapidly and was accepted positively (Kuroda, 2013).

Generally, microcredit and micro-savings are prime services offered in microfinance institutions. along with these, Asian MFIs also started to provide diversified services like trainings for the efficient utilization of loans to the poor clients, fund transfer, leasing, micro-insurance, energy loans, remittance etc. (Bedson, 2009). Microfinance institutions in like Bangladesh and India offered diversified products of micro insurance, microcredit products without any offer related to diversified products. (Asian Development Bank, 2019).

MFIs endeavors to attain dual objective of outreach and financial sustainability. To be sustainable, they MFIs have to bear operating cost without dependance upon donations and subsidies (Shastri, 2009). In order to achieve this, they grant loan to only those clients who can repay the principal loan amount along with interest. In Bangladesh, India and Pakistan, MFIs are financially sustainable (Bedson, 2009). Other objective of outreach, can only be attained by targeting the poor segment. Those MFIs have to face high default rate who focused on outreach. Bangladesh is considered as the most successful country in terms of outreach attainment. The outreach focused MFIs have to depend on international donations and government subsidies. Microfinance institutions have also to analyze the entrepreneurial skills of their borrowers and the need behind loan demand (Shastri, 2009).

Microfinance sector is using two types of methodology to grant loans one is individual lending and other is group lending (Fernando, 2000). The more popular of these two is group lending inspired from Grameen Bank model. Bangladesh was actually the first country who introduce group lending strategy where groups consist of eight to ten persons were selected for tiny loans. On the other side, individual lending grant relatively large amount of loans for credit worthy and well reputable poor clients. In this regard, Pakistan is the founder of individual lending to provide credit services for the clients residing in urban areas (Llanto, 2006). In terms of performance and development of MFIs, the largest and highest volume of staff, savings and loans are also found in these countries of South Asia. (Lapenu & Zeller, 2001).

### **LITERATURE REVIEW**

#### **Theoretical Literature**

Like other financial institutions, MFIs also provide loans facing interest rates risk. Along with they also face operational, markets, currencies, liquidity, employment and country risks. Because of the core services of an MFI, credit risk is often the most significant risk for an MFI.

According to Saunders and Cornett (2011) credit risk means “Risk arising from borrowings and securities held by leveraged funds. It may not be possible to pay financial institutions in full, even though credit risk has a significant impact for survival of the bank. This was largely revealed through the global financial crisis. So credit Risk causes banks to fail and MFIs are not immune to the consequences (Fang and Lelyveld 2014).

This is because microfinance consists of small-scale banking services. Microcredit is generally shorter than traditional banking. The payback period is usually around 12 months. Therefore, MFIs may face some challenges like delays in loan repayments that can cause problems within weeks. The same applies to repay issues. From a small number of small customers, it can quickly spread to many customers (Bond and Rai 2009). This situation can cause serious problems for MFIs and the microfinance sector as a whole. For example, between 1996 and 2000, MFIs in Bolivia recorded large refunds problems that cause economic crises (Vogelgesang 2003)

The concept of diversification is central to the portfolio theory developed by Markowitz (1952). This allows for lower portfolio risk compared to the overall risk of individual investments. There are many ways banks can reduce the risks associated with their loan portfolios without reducing their expected rates of return (Emmons, Gilbert, and Yager 2004). There is a wide range of geographical diversity where banking activities are spread across different geographies (urban, regional and national/international). Therefore, using portfolio theory, MFIs can reduce risk through diversification. In particular, strategic diversification reduces credit and liquidity risk and reduces the probability of MFI failure (Liang and Rhoades 1988).

Applying the theory of credit to MFI credit risk, it can be predicted that when credit spreads locally among many lenders, this risk will decrease. The logic of this concept is simple: agricultural problems such as drought can be concentrated in certain geographical areas, industrial closures can affect investors in certain areas, natural disasters can attack villages in cities and regions, and so on. In terms of liquidity risk,

diversification may be more important as it accepts deposits because it may reduce the standard deviation of deposits (Liang and Rhoades 1988).

In contrast, agency theory suggests that diversification is not beneficial for a firm because managers may have greater opportunity to achieve their own benefits at the expense of shareholders wealth (Goetz, Laven, and Levine 2016). Individual components may be more complex than others, which may limit monitoring efforts. Empire building is another result of increased monitoring leadership (Jensen 1986). Effective monitoring can be very difficult for non-governmental organizations, because the owners of these organizations are not financially supported. Most MFIs are classified as non-governmental or non-governmental organizations, so agency theory issues may be more relevant to microfinance than traditional banks. Comparing this discussion with portfolio theory and agency theory and using a real approach to this problem, the increase in the number of diversity problems can be a problem for MFIs. For example, according to Winton (1999), diversity makes customer management difficult. Thus, institutional fragmentation and the inability to monitor remote borrowers can increase MFIs credit risk

### **Empirical literature and hypothesis development**

Microfinance institutions (MFIs) play a critical role in providing financial services to unbanked and underbanked populations, particularly in developing economies. Risk management is essential to ensure the sustainability and effectiveness of MFIs. Diversification has emerged as a key strategy to mitigate risks within these institutions. This empirical literature explores the existing body of research on diversification and risk in microfinance institutions, examining key findings, methodologies, and implications.

Empirical studies in banking financial institutions have evidenced mixed results. Some determined decrease in risk with adoption of diversification strategies while others found that diversification

helps in the higher performance of banks having low risk level (Acharaya, 2006). Some findings consistent with modern portfolio theory reveals that when banks diversify into different financial services, risk was reduced (Laeven & Levine, 2016). When financial institutions are more diversified specially geographically, their risk level increases (Laeven & Levine, 2012). These contradictory findings are also examined in case of microfinance industry and different type of diversification strategies were observed like product, revenue, geographical and asset diversification. Banerjee and Duflo (2009) studied the impact of introducing various financial products within MFIs in India. They found that product diversification reduced MFIs' vulnerability to economic shocks by decreasing their dependence on a single product. Cull, Demirgüç-Kunt, and Morduch (2009) investigated the relationship between geographic diversification and risk management in MFIs. They found that MFIs operating in multiple regions were less exposed to regional economic or political shocks, improving their financial stability. Zamore (2019) also examined role of geographical diversification for credit risk in the global context of microfinance industry. Hermes and Lensink (2011) analyzed the role of portfolio diversification in credit risk management within MFIs. Their research showed that a balanced loan portfolio, which includes loans of different sizes, helped reduce credit risk by reducing overexposure to specific groups of borrowers.

Bogan and Chiquier (2009) explored how diversification affected MFIs' exposure to market risk. They observed that diversification led to a reduction in market risk, especially when combined with effective hedging strategies. Many studies in this area employ quantitative analysis to evaluate the impact of diversification on risk. Various statistical techniques, such as regression analysis and event studies, are generally used to analyze large data sets of MFIs. Some researchers have conducted in-depth case studies on specific MFIs, providing valuable insights into diversification strategies and

outcomes. These studies often involve qualitative analysis and interviews with key stakeholders. Among the problems, the current study also suspects the negative impact of diversification for MFIs. Generally, results from a traditional financial institution are not satisfactory to represent a specific framework for microfinance institutions.

H1: There is significant relationship between revenue diversification and credit risk

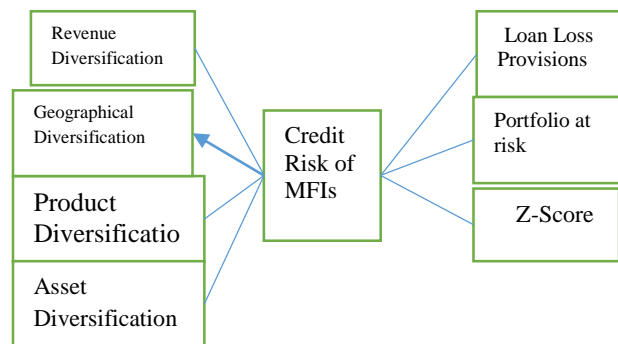
H2: There is significant relationship between geographical diversification and credit risk

H3: There is significant relationship between asset diversification and credit risk

H4: There is significant relationship between product diversification and credit risk

In conclusion, the empirical literature indicates that diversification is a valuable tool for managing risks in microfinance institutions. When implemented thoughtfully and strategically, it can improve the resilience and sustainability of MFIs while contributing to their mission of financial inclusion and poverty alleviation. However, careful consideration of the unique challenges and opportunities associated with diversification is essential to its successful implementation. The conceptual model of the study is shown in figure 1

**Figure 1**  
*Conceptual model of the study based on literature review*



**Methodology and Data collection**

**Data and Sample of the study**

This study is quantitative and descriptive in nature to explain the relationships between the variables. All secondary data of MFIs, collected, maintained and supported by the World Bank on the Microfinance Institutions Exchange (MIX market).

The population of the present study consists of a dataset of total MFIs in South Asia listed on the MIX market. The sample of this study consisted of a total of microfinance institutions from 03 South Asian countries, Pakistan, India and Bangladesh (1,216 observations) during 2012-2019.

Sampling is based on the following criteria. i) MFIs listed on the MIX market. ii) MFIs have data availability from 2012 to 2019. iii) Those MFIs are selected in sample with data of at least five years

**Table 1**

*Details of Sample MFIs on the basis of countries*

Country	Total Population (Registered MFIs)	MFIs included in Sample
Pakistan	57	25
India	250	79
Bangladesh	86	31
Total		135

The sample of current study is updated version of Githaiga, 2021; Churchill, 2020; Zamore, 2018; Mersland & Strom, 2016; Mersland & Strom, 2013. This data set would cover almost all aspects of diversification in MFIs, outreach, risk perspective (Delgado et al. 2015).

**Variables description**

In the conceptual and empirical model, risk of MFIs is dependent on the diversification as independent variable (Figure 1). Several control variables are also included in this study as per previous literature. Current study has measured diversification with respect to various dimensions as revenue, product, asset and geographical aspect.

For measurement of revenue diversification (RD), HHI (Herfindahl Hirschman Index) is used as per literature evidence (Strioh & Rumble, 2006). RD is a combination of income generated from lending operations and non lendings activities. A higher value of RD indicates more diversification while a value close to 0 reveals more concentration (income from single source of loan). The calculation of RD is as under equation.

$$HHI = \frac{\text{Financial Revenue from loans}}{\text{Total Financial Revenue}} +$$

$$\frac{\text{Financial Revenue from non-loans operations}}{\text{Total Financial Revenue}}$$

$$RD = 1 - HHI$$

Geographical diversification is measured with the help of total branches that any MFI have

Risk of MFIs is dependent variable of current study. This is firstly measured by Credit Risk. First measure of the credit risk is also used in banking sector as Kwan and Eisenbeal (1997), has defined it as part of the debt. It's a small time of 30 days as money is small. The maximum duration for the funding are often about 12 months. And the numbers referred to a 30-day PAR30. Par30 is used in other surveys such as Caudill, Gropper and Happerska (2009) and Mersland and Strøm (2009). Increasing the Par30 show that most borrowers can't repay their loan within 30 days.

PAR30 is the most accepted measurement in Literature (Chikalipah, 2017; Abdullah & Quayes, 2016)

$$PAR = \frac{\text{total outstanding loans}}{\text{gross loan portfolio}}$$

Another risk measure used in microfinance is loan loss provision (LLP) (Randøm and Merøland 2015, Caudill, Gropper 2009). The minimum part of the loan is reserved in LLP for future loan losses Ahlin, Lin and Maio 2011). Current study has measured risk of MFIs also by Z-Score as it is better measure than non-performing loans. (Laeven & Levine, 2007).

The z-score is defined as the number of standard deviations from the mean of composite risk. It is calculated as composite risk minus its mean divided by its standard deviation per MFI. The

zscore has been used in prior studies, e.g., Meslier et al. (2016).

Z-score = Mean - Composite risk/SD  
 (Compositerisk)

Current study also employs some control variables also used in previous studies (Githaiga, 2021; Zamore, 2018; Hermes, Lensink & Meesters, 2011). Researcher has controlled these relevant factors to determine the true relationship among dependent and independent variables. Firm size also affects sustainability as large firms get the advantage of economies of scale. Size of MFIs is measured as log of total assets (Mersland & Strom, 2014). There is tradeoff between outreach and sustainability of MFIs (Churchill, 2020). Outreach measures total number of active borrowers.

Political stability is also included as control variable in current study. Political stability index by World Bank, World Governance Indicators (WGI) explain the level of political instability. MFIs are found more established in political unstable economies (Kaufmann, Kraay, & Mastruzzi, 2011). In addition, following Sanya & Wolfe (2010) approach some country level control variables are also included as GDP growth that is the annual growth rate of GDP and inflation, consumer price index.

Baswed on the outcome variable following are the three model equations for multiple regression analysis where DIV stands for diversification measures.

$$\text{Model 1} \quad LLP = \beta_0 + \sum_{i=1}^i \beta_i DIV_{it} + \sum_{j=1}^j \beta_j CV_{it} + \mu_{it}$$

$$\text{Model 2} \quad PAR_{it} = \beta_0 + \sum_{i=1}^i \beta_i DIV_{it} + \sum_{j=1}^j \beta_j CV_{it} + \mu_{it}$$

$$\text{Model 3} \quad Z - Score_{it} = \beta_0 + \sum_{i=1}^i \beta_i DIV_{it} + \sum_{j=1}^j \beta_j CV_{it} + \mu_{it}$$

**Table 2**  
*Variables description*

variable	Definition	Source
Revenue Diversification	Herfindahl Hirschman Index	MIX market
Geographical Diversification	Total branches that any MFI have	MIX market
Asset diversification		MIX market
Product Diversification	Dummy of 0 if loan product, 1 otherwise	MIX market
Loan Loss provisions	Percentage of loan reserved for future loan losses	MIX market
Z-Score	Calculated as the difference between composite risk (sum of portfolio at risk and Write off) and its mean divided by its standard deviation	MIX market
Portfolio at risk (30 days)	Ratio of outstanding to gross loans	MIX market
Size	Natural Logarithm of total assets	MIX market
Outreach	Total number of active borrowers	MIX market
Political Stability	Political stability index	World bank
Inflation	Consumer price index	World bank
GDP Growth	Gross domestic product annual growth rate	World bank

**Data Analysis and Findings**

**Descriptive Summary**

Table 3 of descriptive summary describes mean, standard deviation, minimum and maximum values(Jackson, 2009). On average, total 5 percent of loan are outstanding for 30 days, about 4 percent is reserved as loan loss provisions. Average value of other measure of risk, Z-score for MFIs is higher than Par30 and is 7.8 which shows that MFIs are exhibiting higher level of risk. This is in line with mission of MFIs to serve poor families and microentrepreneurs.

**Table 3**  
*Descriptive Summary*

Variables	Mean	Standard Deviation	Minimum	Maximum
LLP	4.149	4.409	1	45.11
Par30	4.931	4.999	.05	15.53
Z-score	7.895	.342	7.134	8.176
RDIV	.106	.109	.002	.319
ADIV	.031	.087	-1.193	.603
GDIV	24.687	63.224	1	173
PDIV	.634	.482	0	1
Size	7.122	1.035	4.834	9.896
Outreach	165308.69	714280.42	76	7100000
Political Stability	37.307	18.622	9.524	92.857
Inflation	127.747	15.143	106.563	168.183
GDP Growth	6.406	2.041	-3.732	23.514

Current study has examined the diversification impacts with the help of various dimension like revenue diversification for which HHI is used, geographical diversification, asset diversification and product diversification. Average score of first measure, revenue diversification is 0.106 that is lower than RDIV value of 0.3 observed in banking sector. It describes that on average this 10% revenue is generated from non- interest revenue sources of MFIs.

Average value of asset diversification (ADIV) is 0.031 that describes that on average revenue generated from non lending financial services is 3%.. product diversification (PDIV) has mean of 0.634 that describes that loan products are the main source of overall revenue, average revenue is generated from financial loan services of MFIs in this region. Average value of geographical diversification (GDIV) reveals that on average every MFI is having 34 branches in showing network expansion of MFIs.

Researcher has also employed various control variable like size, outreach, political stability and GDP growth and inflation. The average size of MFIs in sample of the study is 7.122 million that is obtained by natural logarithm of total assets.. On average, size reveals that MFIs are enough

large in size to meet their operational cost. The average value of outreach of MFIs in sample of the study is explaining that on average each MFI is serving 1.6 million clients. The mean value of political stability (PS) of three countries is 37.30 which. shows that overall, all countries are politically stable. The average value of inflation is 127.74 which is high inflation. Last control variable, GDP growth has mean value as 6.406.

**Correlation Matrix**

Next, the pairwise correlation test is applied in current study to determine the direction and strength of the relationship (Kennedy, 2008). Table 4 reveals that most of the r values are found significant at 10 percent level and less that 0.50. some values are greater that 0.7 but less than the threshold hair et.al (2010). Alongwith all VIF values are found less than 5 that evidenced that data has no issue of multicollinearity

**Multiple regression analysis**

Due to existence of omitted variable biasness for macro institutional factors, reverse causality and endogeneity, traditional OLS (ordinary least square) model determines unreliable outcomes. Further, according to Wang (2021), this traditional technique of OLS like pooled OLS, random effect and fixed effect models, also reveals problems as endogenous variable are omitted. To address all these deficiencies of OLS technique, Arellano and Bond (1991) introduced Generalized Method of Moment (GMM) approach. They proposed that difference GMM is employed to resolve the problems of endogeneity. Moreover, individual effect error is also controlled here. Afterwards, system GMM was suggested more efficient as compared to technique of difference GMM with the help of using Monte Carlo simulations. According to Blundell and Bond (1998), for small sample with weak instruments, biased results are obtained with difference GMM



**Table 4**  
*Correlation Matrix*

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Variables	VIF	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) LLP	1.02	0.576*											
(2) PAR30	2.29	-0.224*	0.690*										
(3) ZSCROE	1.34	0.227*	0.261*	-0.290*									
(4) RDIV	1.21	-0.141*	-0.236*	-0.182*	0.369*								
(5) ADIV	2.09	-0.120*	-0.140*	-0.080*	0.309*	-0.300*							
(6) GDIV	2.76	0.076*	0.147*	0.156*	-0.163*	0.159*	-0.091*						
(7) PDIV	1.98	0.124*	0.054	-0.042	-0.122*	0.144*	0.012	0.011					
(8) size	3.02	0.005	-0.103*	-0.021	-0.099*	0.089*	-0.094*	-0.071*	0.429*				
(9) outreach	1.17	-0.036	-0.016	-0.022	-0.097*	0.106*	0.056	-0.036	0.466*	0.008			
(10) PS	2.90	0.200*	0.179*	0.239*	-0.327*	0.328*	-0.097*	-0.120*	-0.189*	0.127*	0.389*		
(11) inflation	3.13	0.091*	0.047	-0.049	-0.152*	0.173*	0.024	-0.021	-0.069	0.182*	-0.147*	0.114*	
(12) GDP Growth	1.39	0.079*	0.051	-0.074*	-0.064	0.070*	-0.111*	0.007	0.028	0.088*	0.087*	0.018	-0.062

The preference of system GMM over difference approach is also based upon its moment condition requirement and endogenous lagged dependent variable (Wang, 2021). Moreover, GMM approach has also capability to overcome inherent issues of panel data like heterogeneity and endogeneity problems. Furthermore, the advanced form of system GMM was developed in Stata software by Roodman (2009) with the help of xtabond2 command. But before applying this command of xtabond2, certain conditions need to be fulfilled. Firstly, panel must be short (where N must be larger than T). Then, descriptive variable must have correlation with error term, dynamic dependent variable, fixed effect at individual level, problems of autocorrelation and heteroscedasticity. Another unique feature is that Xtbond2 also estimate outcomes for Sargan and Hansen tests. According to Roodman, 2009, existence of first and second order autocorrelation are also checked with the help of Arellani-Bond Test of AR (1) and AR (2).

**Table 5**  
*Multiple Regression Analysis-System GMM with xtbond2*

	Model I	Model II	Model III
Dependent Variable	LLP	PAR30	Z-SCORE
Variables	Coefficient	Coefficient	Coefficient
Lag_LL	.25***		
Lag_PAR30		.227***	
Lag_Z-SCORE			.373***
RDIV	-9.469	7.214*	.316**
ADIV	3.471*	12.473***	.69**
GDIV	.011***	.014**	0.001***
PDIV	.045	-.418***	.034
Size	-.361	-.351	.013
Outreach	0	0	0
Political Stability	.115***	-.059***	.003***
Inflation	-.049	-.04***	.002***
GDP Growth	-.226	-.098*	.007*
Constant	16.84**	12.868*** 178.309***	4.391***
Wald Chi square	105.520***	6.63	232.603***
Hansen Test	3.80	-4.01***	11.84
Arellano-Bond Test for AR (1)	-5.70***	0.39	-4.72***
Arellano-Bond Test for AR (2)	0.35		1.31

Source: researcher own calculations based on data collected from MIX market

Note: \*\*\* Significant at 1% level, \*\* Significant at 5% level, \* Significant at 10% level

Therefore, current research has also applied system GMM approach with the help of command of xtbond2 as in line with existing literature. With xtbond2 command, post estimation test of system GMM are also justified (Jayasuria & Burke, 2013; Pawlowska, 2016; Kastratovic, 2019). Detailed system GMM results for all the models are given in table 5.

The role of diversification is checked with help of its four dimensions; revenue, asset, product and geographical and credit risk is measured with the help of LLP, Par 30 and z-score.

Results in table 5 shows significant impacts of asset and geographical diversification with all the three measures of credit risk, LLP, Par30 and z-Score of MFIs thus we accept H3 and H4. While in case of revenue and product diversification, we partially accept H1 and H4 as The beta coefficient value of revenue diversification with PAR30 and Z-score are significant at 10 % level but with LLP it shows insignificant negative relation

While asset diversification is found to cause 3.47 units change in LLP, 12.473 units change in Par30

and 0.69 units in z-score This impact is positive and significant at 10,1 and 5% level. When geographical diversification is regressed with credit risk measures, they are observed to have significant positive relation with coefficient values of .011, .014 and .001. These finding clearly indicate that MFIs with greater number of branches have higher default rate as compared to those having less branches. This also reveals that disadvantages of diversification like increased agency cost and complicated operations offset the advantages as suggested by modern portfolio theory. These finding are also consistent with those of Zamore, 2019.

In these model, the control variables of inflation, political stability and GDP growth are found to have significant relation. Among others, size and outreach of MFIs are having insignificant relationship.

Due to heteroscedastic robust estimates, Wald Chi square test has checked the goodness of fit and significance of the regression model of current study The Wal Chi square values of 105,178.30 and 232 reveal the good fit of the three models having significance level of 1%. Results presented in Table 5 shows that Hansen test is insignificant. Further, the presence of AR(1) and non-existence of AR(2) is confirmed with the help of Arellano-Bond test.. Moreover, lagged value of credit risk measures as

dependent variables are also significant which validate the endogeneity issues in these models of panel data study.

### **Conclusion and Discussion**

This study has determined the relationship between various dimensions of diversification on credit risk of microfinance in three countries of south asia, Pakistan, India and Bangladesh.. The findings suggest significant positive impact of various dimensions of diversification on credit risk of MFIs in the sample countries. Diversification seems not beneficial with respect to risk as it cause higher non-performing loans, loan loss provisions and write offs as well. With a vast network of MFI, monitoing the operational activities of loan becomes complex so the group lending is the solution to get maximum benefits of divcersiifctaion strategies

The debate on diversification measures and credit risk in MFIs highlights several key aspects that influence their overall performance and sustainability as well Firstly, diversification in MFIs involves trade-offs between risk reduction and operational complexity. The more diversified an MFI's portfolio is, the more complex its operations become. This complexity may require greater staffing capacity, technological infrastructure, and monitoring systems. Then, the regulatory environment in which MFIs operate can greatly influence their diversification strategies. Some regulatory bodies may impose restrictions on the types of services or products that MFIs can offer, which may affect their ability to diversify. Furthermore, every MFI has to understand the client requirement of product and services through market research for adoption of most appropriate diversification strategy. Lastly, their social mission of poverty alleviation and excess to the poor segment should not be compromised due to competitive diversified products

In conclusion, diversification is a key tool for risk management in MFIs. When applied thoughtfully and strategically, it can enhance the resilience of microfinance institutions and enhance their ability to achieve their social mission. However, it is important to strike a balance between mitigating risks and maintaining the core objectives of the MFI.

The empirical literature on diversification and risk in microfinance institutions highlights several policy implications. they should foster a regulatory environment that allows MFIs to diversify their product and service offerings while maintaining responsible lending and client protection. MFIs must adopt a client-centric approach when diversifying, aligning new products and services with the needs and preferences of their target clientele. In addition effective risk management within MFIs requires continuous monitoring and evaluation of diversification strategies to assess their impact on portfolio quality, financial performance and social mission.

To conclude, this study has also faced some limitations as data is collected from World Bank Database for those MFIs which are registered at MIX. At MIX market website, some of the received data were not available for the whole population. moreover the classification of MFIs is not evident like non-banking MFIs, Banking MFIs, NGOs, etc. so the segregation of data is not possible to check the impacts of diversification according to this aspect of MFIs. this study is limited to risk, future research can examine the effect of diversification with perspective of social performance and a survey from managers can also be conducted

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