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Does microfinance affect economic growth? Evidence from Bangladesh based on ARDL approach

Yousuf Sultan¹ and Mansur Masih*

Abstract

Microfinance, a tool for providing improved access to finance (i.e. deposits, loans, payment services, money transfers and insurance etc.) to the unbanked population of a country, may have impact on domestic economic growth according to some literature. However, according to others, microcredits are just means to exploit the poor, by charging higher interest rates and cost of loans, thus making the poor poorer and the rich richer. The present study intends to empirically test the theoretical relationship between microfinance and the economic growth. It examines whether there is any cointegration among microfinance, growth and other macroeconomic variables. And if there is any, whether there is a lead-lag relationship between microfinance and growth, and which leads the other. The study is carried out using a time series technique ‘Auto-Regressive Distributive Lag (ARDL)’, based on annual data from years 1983-2013. It is the first attempt, in our knowledge, to test micro-macro relationship based on annual time series data from Bangladesh, the founding country of microfinance. Our findings tend to indicate that: (i) There is significant impact of microfinance on domestic growth (GDP). (ii) Growth also has strong relationship with microfinance. This implies that there is bi-directional relationship between microfinance and growth and that microfinance is an important “ingredient” in promoting growth through various channels. The results suggest that microfinance institutions should be supported and promoted by ensuring proper legal and regulatory policies, frameworks and institutions. Islamic microfinance should be allowed to flourish, incorporating *qard al-hasan*, *sadaqah*, *zakah* and *waqf* models along with others to alleviate poverty.

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Key terms: *microfinance, economic growth, financial development, ARDL*

Introduction

The concept of microfinance (microcredit) was introduced by Muhammad Yunus, a Bangladeshi Professor in Economics, in 1970, which earned him the Nobel Peace Prize in 2006¹ and Presidential Medal of Freedom in August 2009 by US President². It has, since then, grown into worldwide movement & gathered momentum to become a major force in Bangladesh as well; attracting the attention by its successful lending practices, poverty alleviation impact and women empowerment.

Bangladesh has its 31.5% of total population living below poverty line (World Bank, 2010) and 17.6% living in absolute poverty (BBS, 2010). The GINI index score of 32.1 indicates a higher trend in income inequality in the country. Economic disparity, illiteracy, lack of proper health and sanitation facilities are some of the major problems of the country. With vast majority of people living in rural areas, underemployment and unemployment is a regular phenomenon, particularly in rural areas. It results in uneven distribution of income which causes serious setback in balanced geographical growth as well as growth of GDP. (Main Uddin, 2008)

Microfinance is generally defined as financial institutions that provide financial services to the poor unbanked population. There are an estimated 2.5 billion financially excluded adults today, with almost 80 percent of those living under \$2 per day having no accounts at formal financial institutions. Three-quarters of the world's poor lack a bank account because of poverty, costs, travel distances and the often burdensome requirements involved in opening an account. Moreover, they are denied credit by formal financial and banking institutions because of lack of knowledge as well as formal rules which they have to follow to get a credit from these institutions. Microfinance institutions provide most of the basic services of banks to those people, namely collecting deposits, making loans, and providing insurance services etc. (Adonsou & Sylwester, 2015; Leone & Porretta, 2014; Kunt et al., 2015)

¹ "The Nobel Peace Prize for 2006". NobelPrize.org. 13 October 2006. Retrieved 08 May 2016.

² "House and Senate Leaders Announce Gold Medal Ceremony for Professor Muhammad Yunus", Press Release, US Congress. Speaker.gov. 05 March 2013. Retrieved 08 May 2016.

The microfinance industry has tremendously increased its intermediation activities over the last decade, particularly in developing countries. Their total assets have increased by more than 2,000% from 2002 to 2015.³ As shown in Table 1, total assets, gross loan portfolios, and deposits in countries across the regions have significantly increased between 2002 and 2013. Total assets have increased by 2,995%, whereas the gross loan portfolio have increased by 3,639%. In terms of borrowers, the increase is also very noticeable. The number of active borrowers has increased by 1,112%. The huge increases in these indicators demonstrate the rapid growth of microfinance.

TABLE 1: CHANGE IN MICROFINANCE INDICATORS ACROSS THE REGIONS FROM 2002 TO 2013

<i>Region</i>	<i>Borrowers %</i>	<i>Assets %</i>	<i>Loans %</i>
<i>Africa</i>	204%	427%	540%
<i>East Asia and the Pacific</i>	6%	182%	239%
<i>Eastern Europe and Central Asia</i>	153%	754%	867%
<i>Latin America and The Caribbean</i>	98%	343%	416%
<i>Middle East and North Africa</i>	176%	337%	443%
<i>South Asia</i>	474%	951%	1136%
<i>Total</i>	1112%	2995%	3639%

Source: Author's own calculation based on data from Mix Market

According to Microfinance Outlook 2015, the global microfinance market achieved growth of 15-20% in 2015. Asia displayed the strongest growth momentum. According to the International Monetary Fund (IMF), economic growth in the 20 most important microfinance markets was predicted increase from 4.4% to 4.8% in 2015. This means that

³ Microfinance Information Exchange (www.mixmarket.org)

microfinance countries will probably grow at twice the rate of developed economies. (Etzensperger, 2014)

THEORETICAL AND EMPIRICAL UNDERPINNINGS:

Does microfinance have any impact on financial development and economic growth? Or does economic growth promote microfinance? Is there any theoretical relationship between the two? Does one of them lead the other? We needed an answer.

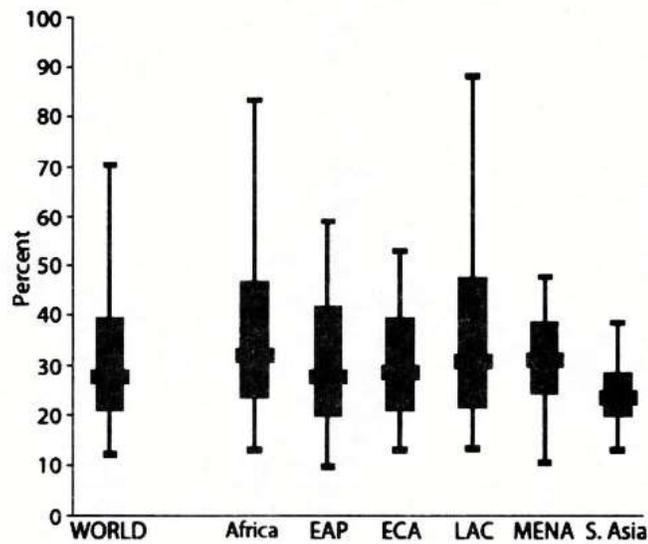
Theoretically, microfinance promotes well-functioning financial sector, which is critical for efficient resource allocation, leading to increased productivity, greater investment, and higher overall levels of economic growth. It is evident from numerous literature that there is a positive effect of the financial sector (i.e. debt and equity markets, banking) on economic growth at the firm, industry and country levels. Moreover, development oriented scholars opine that what actually matters is the access to finance measured by its depth and outreach. An improved access to finance is needed to ensure sustainable economic growth, so that low-income households, that still constitute a majority, have chances to escape from poverty. (Aziz & McConaghy, 2014; Alimukhamedova, 2013)

While studying the transmission channels of microfinance to economic growth, Alimukhamedova (2013) finds that microfinance envisages the integration of the financial needs of households into a country's financial system and hence is expected to positively affect the growth. Even though it is thought that the immediate channel of microfinance impact is through reducing income inequality and poverty, however, such an impact is in long-term. Financial development through microfinance can be seen in four ways. First, financially sustainable MFIs can promote market deepening that in turn advances financial development. Second, microfinance is seen as a powerful tool in countries with poor governance that hinders development programs. Third, microfinance could facilitate financial market maturity in both developed and developing countries. Finally, microfinance could help to support domestic financial reforms by breaking down constraints.

On the other hand, Adonsou & Sylwester (2015) argues that the increase in intermediation by microfinance institutions comes at a cost to the borrower. MFIs are believed to charge

high interest rates. The median interest rate charged by microfinance is about 27%, while this can greatly vary across regions (see figure 1). Thus, while microfinance intermediation of servicing the poor increases over time, high interest rates may hinder microfinance’s ability of aiding the very poor. And it may not promote economic growth as well. Thus, theoretically the issue remains inconclusive.

FIGURE 1: MICROFINANCE INTEREST RATES IN 2011



Source: Rosenberg, Gaul, and Tomilova (2013)

Empirically, Adonsou & Sylwester (2015) finds that the growth of microfinance loans has a positive and significant effect on economic growth and total factor productivity. Buera et al (2012) concludes that microfinance can have significant effects on output, capital, wages, interest rates, and total factor productivity. Ahlin & Jiang (2008) and Yusupov (2012) also found earlier that microfinance can have significant macroeconomic effects.

On the other hand, Alimi (2015), while studying the link between financial development and economic growth in Sub-Saharan African countries, finds that financial development has not led to economic growth in the panel of the selected countries. Copestake & Williams (2011) argues that microfinance cannot, on its own, be relied upon to deliver sustained income growth and falling poverty rates, and that it can indeed be harmful to a significant minority

of recipients. Woolley (2008) finds no significant correlation between three financial variables and two outreach variables with domestic GDP growth.

Based on the aforementioned empirical results, the issue remains inconclusive empirically as well. Thus, we need to test conclusively whether there is a theoretical relation between microfinance and economic growth, and whether they move together in the long run. In addition, we need to see which one of the two leads the other, so that the results provide specific suggestions to the policy makers. This study is therefore a humble effort to answer those questions.

This study is the first humble attempt to empirically test the relation between microfinance and economic growth in Bangladesh market – which is the founding country of microfinance. The study is based on time-series data between 1983 and 2013, using the ‘Auto-Regressive Distributive Lag (ARDL)’ model.

Our results suggest that there is significant impact of microfinance on the domestic growth (GDP). And that growth also has strong relation with microfinance. This implies that microfinance is an important ingredient in shaping the financial inclusion, thus promoting financial development and growth through various channels.

The structure of the paper is as following: Section 2 summaries and reviews both theoretical and empirical literatures on our research agenda. Section 3 provides an overview of Islamic microfinance models. Section 4 explains the methodology. Section 5 presents ARDL cointegration tests and discusses the results. The last section concludes.

Literature Review

The literature review is based on two types of literatures. a. Literatures that studied the impact of microfinance on growth. And b. Literatures that studied the impact of economic growth on development of microfinance.

As for the first type, there are a number of literatures that found significant impact of microfinance on the economic growth. Adonsou & Sylwester (2015) investigated the macroeconomic effects of microfinance using a sample of 71 developing countries over the

period 2002-2011. They found that the growth of microfinance loans has a positive and significant effect on economic growth and total factor productivity. As far as investment and education are concerned, they did not find strong evidence of positive effects from microfinance loans. Their results suggest that microfinance leads to development in developing countries. However, given the small economic impact of microfinance, the development process will not be swift.

Raihan et al. (2015) studied that the contribution of microfinance to GDP in Bangladesh and found that in 2012 the impact was between 8.9 percent and 11.9 percent depending on the assumption of the labor market. Furthermore, the contribution of rural microfinance to rural GDP in Bangladesh in 2012 was between 12.6 percent and 16.6 percent depending on the assumption of the labor market. However, such estimation is subject to underestimation due to two major reasons: (i) the model didn't consider underemployment, and the labor market adjustments compensate some of the negative effects generating from withdrawing of MFI-capital; and (ii) the share of the rural GDP might be lower than 60 percent as very high urban income are not usually captured by household survey; and this would imply that the contribution of rural microfinance to rural GDP in Bangladesh would be even higher.

Maksudova (2010) found that there is evidence of microfinance to Granger-cause economic growth and it is positive only in less developed countries through lagged values where formal financial intermediation is immature, leaving significant space for alternative means such as microfinance. However, with further economic development this contribution has risk to be negative as middle income countries already face it through current values. Sharma & Puri (2013) studied the inter relationship between GDP and Micro loans to Self Help Groups (SHG). They found a very high level of correlation, i.e. 0.96, between the variables and a significant impact of Microloans on GDP.

However, some other studies found no or less relationship between microfinance and economic growth. Alimi (2015) examined the link between financial development and economic growth in 7 Sub-Saharan African countries - Nigeria, South Africa, Lesotho, Malawi, Sierra Leone, Botswana and Kenya. He found that financial development has not led to economic growth in the panel of the selected countries when domestic credit provided

by the banking sector is used as a proxy for financial development. The results thus lend support for the independent hypothesis postulates that financial development and economic growth are causally independent.

Buera et al. (2012) found that the redistributive impact of microfinance is stronger in general equilibrium than in partial equilibrium, but the impact on aggregate output and capital is smaller in general equilibrium. Aggregate total factor productivity (TFP) increases with microfinance in general equilibrium but decreases in partial equilibrium. When general equilibrium effects are accounted for, scaling up the microfinance program will have only a small impact on per-capita income, because the increase in TFP is counterbalanced by lower capital accumulation resulting from the redistribution of income from high-savers to low-savers. Nevertheless, the vast majority of the population will be positively affected by microfinance through the increase in equilibrium wages.

Copestake & Williams (2011) tentatively concluded that microcredit cannot, on its own, be relied upon to deliver sustained income growth and falling poverty rates, and that it can indeed be harmful to a significant minority of recipients. Evidence of impact on intermediate indicators including business activity, business profitability and asset ownership is generally more positive, but this in turn has not been shown to increase income or reduce poverty, not least because of the opportunity cost of time taken up with such activities.

Woolley (2008) argued that none of the microfinance variables and domestic GDP growth are significantly correlated. He mentions that this may be the result of a biased sample, it still suggests that some institutions are able to perform financially and in terms of outreach without being affected by domestic GDP growth. This result suggests that institutions can operate successfully in situations of low GDP growth, that they don't necessarily maintain high financial success at the expense of outreach and that perhaps there are some intrinsic characteristics of microfinance institutions that make them so resilient.

As of the second type of literatures, there has been studies to measure the success of microfinance as an effect of macroeconomic growth. Ahlin & Maio (2011) concludes that MFIs are more likely to cover costs when growth is stronger; and MFIs in financially deeper economies have lower default and operating costs, and charge lower interest rates. There is

also evidence suggestive of substitutability or rivalry. For example, more manufacturing and higher workforce participation are associated with slower growth in MFI outreach. Overall, the country context appears to be an important determinant of MFI performance; MFI performance should be handicapped for the environment in which it was achieved.

Alimukhamedova (2013) mentions that strong financial development facilitates poverty reduction, therefore roles played by microfinance and mainstream finance in tackling poverty should be regarded as complementary and overlapping rather than as competing alternatives. A World Bank research indicates that a high level of financial development is a powerful tool to reduce poverty. This implies that as financial sector deepens it also increases its reach, providing financial services directly to the poor. However, financial development does not touch poor people directly; it nevertheless promotes aggregate economic growth, thus benefiting the poorest in a disproportionately better way.

Islamic Microfinance Model

The first microfinance institution that came into existence is Grameen Bank. The model it exercised is best known for solidarity lending. As typical bank loans, the institution gives out loans to the clients. Thus interest is charged, which is often several times higher than general bank credits, as discussed earlier. According to the model, each borrower must belong to a five-member group; the group does not need to give a guarantee for a loan. The loan is made to only one person but the whole group is to make sure that the money is repaid. Each member has to pay for their own loan but if they have problems the group may help them pay because the group would not get any more loans from Grameen if all the groups' loans were not paid. (Seelos & Mair, 2005)

However, now there are numerous Islamic MFIs operating in many countries. Islamic Microfinance has an important role for promoting socio-economic development of the poor and small entrepreneurs without charging interest (*riba*). Table 2 indicates the basic differences between interest based and Islamic microfinance. (Abdelkader & Salem, 2013)

TABLE 2: DIFFERENCE BETWEEN ISLAMIC AND CONVENTIONAL MICROFINANCE

Items	Conventional MFI	Islamic MFI
Liabilities (Source of Fund)	External Funds, Saving of client	External Funds, Saving of Clients, Islamic Charitable Sources (<i>Zakat, Waqf</i>)
Asset (Mode of Financing)	Interest-Based	Islamic Financial Instrument
Funds Transfer	Cash/ loan given	Goods transferred
Deduction at Inception of Contract	Part of Funds deducted as Inception	No deduction at Inception
Target Group	Women	Family
Work incentive of employees	Monetary	Monetary and Religious
Dealing with default	Group/center pressure and threat	Group center, Spouse Guarantee and Islamic Ethic
Social Development Program	Secular, behavioral, ethical and social development	Religious (includes behavior, ethics and social)

Source: Abdelkader & Salem, 2013

In Bangladesh, Islami Bank Bangladesh Limited, has introduced a scheme naming 'Rural Development Scheme (RDS)' in 1995 to create opportunity for generation of employment and raising income of the rural people, and thus moving towards alleviation of poverty. It has been based on Islamic principles and Riba free model, and has been the first Islamic Microfinance Model in the country & throughout the world.

Up to July 2015, IBBL has disbursed a total BDT 115,539.54 million among 922,793 households covering 18,863 villages in 64 districts of the country. 251 branches of the bank have been operating the activities of the scheme in their respective areas. The total outstanding amount is 18,650.66 million. Rate of recovery of the scheme is more than 99.17%. (IBBL, 2015)

TABLE 3: MODES OF FINANCE USED BY ISLAMIC MFIs ACROSS THE WORLD

Mode of finance	Utilization	Practiced by
Murabahah - Cost Plus Sale	Purchase of raw materials, equipment, agri. Inputs, Consumer goods, Vehicle, Houses etc.	Al Baraka Bank, Al Amal Bank, HSBC, Amanah Islamic Bank, Islamic Bank Bangladesh, FINCA-AF, Islamic Relief, BMT's in Indonesia etc.
Salam – Forward Sale	Ideal product for Agricultural Financing, it can also utilize for other business purposes as well	CWCD, Al Barakah MPCS
Istisna - Manufacturing contract	May be utilized for small manufacturing Business, for production use, Micro entrepreneur Development sectors	Meezan bank, Ghana Islamic Microfinance bank, DIB, MayBank, Standard Chartered etc.
Musharaka - Partnership	Can be used for Microenterprise & SME'S setup's, Small productive projects, Working capital financing	CIMB, Amanah Islamic bank, AlBarakah, DIB, etc.
Mudaraba - Partnership	Small Business, Microenterprise setup's, Small productive projects, Working capital financing	Bank of Khyber, Islamic Bank Bangladesh, CWCD, Islamic Relief, Awqaf South Africa etc.
Ijara – Islamic Lease	Auto Financing, Equipment Financing, House Lease, small production unit lease etc.	Al-Amal Microfinance Bank, NRDP, CWCD etc. Amanah Islamic Bank – Philippines.
Diminishing Musharkah	Ideal product for Housing Finance sector, but also utilize for other ventures as well.	CWCD, Ariana Financial Services, Helping hands etc.
Others: Qard-e-Hasana, Waqf, Zakat, Cooperative Model, BMTs, Micro Takaful (Islamic Micro insurance)	Qard-e-Hasana: for Emergency Loan, benevolence loan, Student, Maternity etc. Zakat: Health, Shelter, Safety net programs, Education and where Zakat applicable. Micro Takaful: Micro Risk Management, Crop & Livestock Insurance etc.	AIMS- Malaysia, Akhuwat, Awqaf South Africa, Al-Amal Microfinance bank, BMTs - Indonesia etc.

Several studies has been carried out throughout the years to study the impact of RDS on its clients. Ahmad (2010) studied on 1,020 clients working across the country. The results show

that household income, productivity of crops and livestock, expenditure, and employment had increased significantly due to the influence of invested money. Clients opined that the micro-investment program had provided them with the opportunity to perform their economic activities in a more organized way, leading them to the higher quality of life and also develops their awareness towards health care, proper sanitation, and drinking safe water.

A field survey was carried out by Main Uddin (2008) on the socio-economic impact of RDS. The survey of 50 families suggested that it has large positive impact. It shows that the investment of the day labor has declined from 10% to 6%, agriculture has declined from 14% to 8% transportation services decreased from 16% to 14% .On the other hand, small business has increased from 50% to 60%. This indicates that the majority of the finance were utilized for business. The study also suggests that RDS has improved the lifestyle of its members, in terms of food intake, housing, education, clothing, health and sanitation. One of the most important changes was the creation of employment opportunities, particularly for women. Another survey carried out by Jinan, et al. (2008) in IBBL Mymensingh sadar branch shows that the income change of the participants was satisfactory (small changes 42 percent, medium changes 56 percent and highly changes 2 percent).

Data and Model Theoretical Specifications

The present study is conducted by applying the Autoregressive Distributed Lag model (ARDL) analysis (also known as the Bounds testing procedure), using six variables based on previous studies and our research objective, a number of variables as potential determinants growth and microfinance outreach. The growth variable refers to the country's real GDP per capita and exports of goods & services as percentage of GDP. As the main focus of our study is to examine the bi-directional theoretical relationship between microfinance and growth, we use 'loans and advances' disbursed by microfinance institutions as a proxy of microfinance outreach. In addition to that we have three control variables - real interest rates, inflation rate and exchange rate.

Theoretical Model Specifications

$$GDP = \int (MFLA + EX + INF + XR + INT)$$

GDP = Real GDP per capita, proxy of growth

MFLA = Microfinance Loans & Advances, proxy of microfinance outreach

EX = Exports of Goods & Services (% of GDP)

INF = Inflation (control variable)

XR = BDT Exchange Rate Per USD (control variable)

INT = Real interest rate (control variable)

The data used here are from the country Bangladesh, annual data from 1983 to 2013. A total of 30 observations were obtained. Due to longer duration of the series and many missing values we had to use multiple sources for collecting data for all variables used in the study. 'real GDP per capita' is collected from the World Bank Database, 'inflation' is collected from IMF - World Economic Outlook, 'real interest rates' and 'exports to GDP' are collected from the IMF International Financial Statistics (IFS), 'exchange rates' collected from World Markets Company of Thomson Reuters. Microfinance loans and advances are collected from Grameen Bank⁴, the first microfinance institution in Bangladesh and the whole world. Because of limitation of longer annual time-series data for the country level, and because Grameen Bank is the biggest and first MFI in Bangladesh, so the data from Grameen Bank is taken as proxy of all microfinance institutions in the country.

We have tried our best to collect data of the Rural Development Scheme (RDS) by Islamic Bank Bangladesh Limited, which is the first Islamic microfinance initiative in the country, so that we can compare and contrast the effects of Islamic microfinance as well. But that has not been possible due to time constraints, unavailability of the data in public domains, and our own limitation.

⁴ www.grameen.com

Methodology

We could use either cross-sectional regression or time-series approaches to test the hypothesis whether microfinance leads (or lags) economic growth. However, the cross-sectional approach has a major shortcoming in testing lead-lag relationships because they are not appropriate in capturing the dynamics of the variables involved. Moreover, the implicit assumption of the cross-sectional studies is that the parameters across units/countries remain constant. This assumption is not realistic in the context of developing countries with different institutions, structures and stages of development. The timeseries studies of individual countries are more appropriate for testing the temporal or lead-lag relationship between variables (Masih et al., 2009)

Although the conventional cointegrating procedure has made an important advance on regression analysis by focusing on the point that any regression analysis should start off, not mechanically, but by testing the stationarity and cointegration properties of the time series involved, the cointegrating estimates also are subject to a number of limitations (Masih et al., 2008). The estimates derived from the cointegrating tests (such as the Johansen test) and the unit root tests (such as, the augmented Dicky-Fuller and Phillips-Peron, etc. which precede the cointegrating tests), are found to be biased. The tests lack power and are biased in favour of accepting the null hypothesis. The cointegration tests require the variables to be $I(1)$ but the order of integration of a variable, whether $I(1)$ or $I(0)$, may depend on the number of lags included or whether the intercept and/or the trend are included or excluded in the unit root tests. Moreover, the Johansen cointegrating tests have small sample bias and simultaneity bias among the regressors.

The Auto-Regressive Distributive Lag (ARDL) method (also known as the bounds testing approach) proposed by Pesaran-Shin-Smith (2001) that we have employed is free from the above limitations of the unit root and cointegration tests. The ARDL bounds testing approach does not require the restriction imposed by cointegration technique that the variables are $I(1)$ or $I(0)$. Moreover, the bounds testing procedure employed in this study is robust for small sample size study (Pattichis, 1999; Mah, 2000; and Tang and Nair, 2002). Pattichis (1999) applied ARDL bounds test with 20 observations, whereas studies of Mah

(2000) and Tang and Nair (2002) had observations of 18 and 28 respectively. Furthermore, the bounds testing approach is possible even when the explanatory variables are endogenous (Alam and Quazi, 2003).

The ARDL technique involves two stages. At the first stage, the existence of a long-run relationship among the variables is tested. This is done by constructing an unrestricted error correction model (VECM) with each variable in turn as a dependent variable and then testing whether or not the 'lagged levels of the variables' in each of the error correction equations are statistically significant (i.e., whether the null of 'no long run relationship' is accepted or rejected).

The test consists of computing an F-statistic testing the joint significance of the 'lagged levels of the variables' in each of the above error-correction form of the equation. The computed F-statistic is then compared to two asymptotic critical values. If the test statistic is above an upper critical value, the null hypothesis of 'no long-run relationship' can be rejected regardless of whether the variables are $I(0)$ or $I(1)$. Alternatively, when the test statistic falls below a lower critical value, the null hypothesis of 'no long-run relationship' is accepted regardless of whether the variables are $I(0)$ or $I(1)$. Finally, if the test statistic falls between these two bounds, the result is inconclusive. It is only in this case that the researcher may have to carry out unit root tests on the variables.

As regards the implications of the F-statistics, if all the F-statistics in all equations happen to be insignificant, then that implies the acceptance of the null of 'no long run relationship' among the variables. However, if at least one of the F-statistics in the error-correction equations is significant, then the null of 'no long-run relationship' among the variables is rejected. In that case there is a long run relationship among the variables. When the F-statistic is significant, the corresponding dependent variable is endogenous and when the F-statistic is insignificant, the corresponding dependent variable is exogenous or called 'long-run forcing variable'.

Once the long run relationship has been demonstrated, the second stage of the analysis involves the estimation of the long run coefficients (after selecting the optimum order of the variables through AIC or SBC criteria) and then estimate the associated error correction

model in order to estimate the adjustment coefficients of the error-correction term. Since the data are yearly, we chose one for the maximum order of the lags in ARDL model. Since the observations are yearly, for the maximum order of the lags in the ARDL model we choose 2 and carry out the estimation over the period of 1983 to 2013.

The ARDL model specifications of the functional relationship between Real GDP per capita (GDP), Microfinance Loans & Advances (MFLA), Exports of Goods & Services (EX), Inflation (INF), Exchange Rate (XR) & Real interest rate (INT) can be estimated below:

$$\begin{aligned} DGDP_t = & a_0 + \sum_{i=1}^k b_1 DGDP_{t-i} + \sum_{i=0}^k b_2 DMFLA_{t-i} + \sum_{i=0}^k b_3 DEX_{t-i} + \sum_{i=0}^k b_4 DINFL_{t-i} \\ & + \sum_{i=0}^k b_5 DXR_{t-i} + \sum_{i=0}^k b_6 DINT_{t-i} + b_7 LGDP_{t-1} + b_8 LMFLA_{t-1} \\ & + b_9 LEX_{t-1} + b_{10} LINFL_{t-1} + b_{11} LXR_{t-1} + b_{12} LINT_{t-1} + \mu_t \end{aligned}$$

ARDL bounds testing procedure permits us to take into consideration I(0) and I(1) variables together. The ARDL approach to cointegration involves estimating the unrestricted error correction model version of the ARDL model for GDP and its determinants: The error correction version of the model is as follows:

$$\begin{aligned} DGDP_t = & a_0 + \sum_{i=1}^k b_1 DGDP_{t-i} + \sum_{i=0}^k b_2 DMFLA_{t-i} + \sum_{i=0}^k b_3 DEX_{t-i} + \sum_{i=0}^k b_4 DINFL_{t-i} \\ & + \sum_{i=0}^k b_5 DXR_{t-i} + \sum_{i=0}^k b_6 DINT_{t-i} + b_6 ECT_{t-i} \end{aligned}$$

Where, ECT is lagged error correction term. The hypothesis that we will be testing is the null of ‘non-existence of the long-run relationship’ defined by

$$H_0: b_1 = b_2 = b_3 = b_4 = b_5 = b_6 = 0$$

Against, existence of a long-run relationship.

$$H_0: b_1 \neq b_2 \neq b_3 \neq b_4 \neq b_5 \neq b_6 \neq 0$$

As discussed earlier, we use the following variables for our lead-lag analysis. All the variables (except the inflation rates) are transformed into logarithms to achieve stationarity in variance. All the level forms of the variables were transformed into the logarithm scale but that was not necessary for the inflation rate & interest rate variable, which was originally in percentage form. We begin our empirical testing by determining the stationarity of the variables used. In order to proceed with the testing of cointegration later, ideally, our variables should be $I(1)$, in that in their original level form, they are non-stationary and in their first differenced form, they are stationary. The differenced form for each variable used is created by taking the difference of their log forms. For example, $DGDP = LGDP - LGDP_{t-1}$. We then conducted the Augmented Dickey-Fuller (ADF), Philip-Perron and KPSS test on each variable (in both level and differenced form).

Discussion of the results and findings

A stationary series has a mean (to which it tends to return), a finite variance, shocks are transitory, autocorrelation coefficients die out as the number of lags grows, whereas a non-stationary series has an infinite variance(it grows over time), shocks are permanent(on the series) and its autocorrelations tend to be unity. If the series is ‘stationary’, the demand-side short run macroeconomic stabilisation policies and financial development are likely to be effective and promote economic growth but if the series is ‘non stationary’, the supply-side policies are more likely to be effective in promoting growth with the accumulation of financial and human capital in the long run.

Unit root test

Here we test the stationarity of the variables. We need to make sure that the variables are non-stationary in the level form, as that includes the theoretical part in the variables. We need that for the cointegration tests as we’re to test the theoretical relationship between the variables there. A stationary variable doesn’t contain the theoretical information. We carried out three types of stationarity tests, namely ADF, PP and KPSS. ADF (Augmented Dickey-Fuller) corrects the autocorrelation problem. PP (Phillips-Perron) corrects both the

autocorrelation and heteroscedasticity problems by using Newey-West adjusted-variance method.

TABLE 4: UNIT ROOT TEST

Variables	ADF			PP			KPSS		
Level Form	T-stat	CV	Decision	T-stat	CV	Decision	T-stat	CV	Decision
GDP	-1.22	-3.50	NS	-.559	-3.53	NS	.159	.250	S
INF	-1.74	-3.53	NS	-3.70	-3.53	S	.152	.250	S
XR	-2.42	-3.50	NS	-1.89	-3.53	NS	.197	.250	S
EX	-2.34	-3.50	NS	-4.57	-3.53	NS	.152	.250	S
MFLA	-.129	-3.67	NS	1.28	-3.53	NS	.167	.250	S
INT	-2.50	-3.67	NS	-2.81	-3.53	S	.179	.250	S
	ADF			PP			KPSS		
Differenced Form	T-stat	CV	Decision	T-stat	CV	Decision	T-stat	CV	Decision
GDP	-2.88	-3.04	NS	-4.49	-2.94	S	.264	.379	S
INF	-2.01	-2.95	NS	-9.84	-2.94	S	.189	.379	S
XR	-4.47	-3.04	S	-3.47	-2.94	S	.347	.379	S
EX	-3.83	-3.04	S	-12.70	-2.94	S	.152	.379	S
MFLA	.0560	-2.95	NS	.436	-2.94	NS	.443	.379	NS
INT	-2.84	-2.95	NS	-11.18	-2.94	S	.308	.379	S

Notes: NS denotes non-stationary and S denotes stationary

For both ADF and PP tests, the null hypothesis is that the variables are non-Stationary, and for KPSS, the null hypothesis is that the variables are Stationary. From the results, we look

for the highest value from AIC (and/or SBC) column and check what is the corresponding Test Statistic. Then we compare it with the critical value shown in CV column (or below the table). If the t-statistic is greater than the critical values, we reject the null. Otherwise, we fail to reject the null and accept it.

From the above mentioned table we can see that the result varies from one test to another. We observe different results from ADF and PP tests, however, KPSS shows most of the variables are stationary in both forms, except microfinance variable in differenced form. It is more than evident that the results are not consistent across various tests. Therefore, variables we are using for this analysis are either I(0) or I(1).

As the results of unit root test are not consistent we decided to use ARDL technique to test the long run relationship among the variables. Before proceeding with the test of cointegration, we try to determine the order of the vector auto regression (VAR), that is, the number of lags to be used.

VAR Order Selection

In this step we test for the number of lags (VAR order). From the output for selection of order of the VAR Model, we find the highest value for AIC and SBC and check the corresponding lag order. We may look at the column with Adjusted LR test as well. Once (from bottom to up) p-value is greater than 5%, we stop there and take the corresponding lag order. If results are conflicting, we take the lower order if there is no autocorrelation. As per the table below, results show that AIC recommends order of three whereas SBC favours two lags.

TABLE 5: VAR ORDER SELECTION

		Selection criteria	
		AIC	SBC
Optimal order of the VAR	3	3	2

It is evident that there are conflicts between the recommendations of AIC and SBC. This can be interpreted as an inherent nature of time series data of our study. As we have yearly data and observation is only 30, we take maximum 3 VAR order, AIC gives us 3 lags whereas SBC shows us 2 lag. In order to proceed to the next stage, we have decided to choose 2 lag order.

Testing Cointegration

In this step, we are check whether our variables move together (cointegrated) in the long run or not. This tests the theoretical relationships among the variables. We performed Engle Granger and Johansen tests of cointegration for our purpose. The difference between the two is that Engle-Granger test uses residual based approach. It only can identify one cointegration. Whereas Johansen test uses maximum likelihood. It can identify more than one cointegration. Engel Granger tests if error term is stationary or not. It'll not create a stationary error term. If the variable is stationary, EG says, the variables will go together in the long run. Johansen, on the other hand, creates the stationary error term. If there are two combinations, we say, two cointegrations. If three, we say, three cointegrations.

TABLE 6: ENGLE –GRANGER (E-G) TEST

		T-statistics	Critical value
Order of the ADF test	2	-2.2463	-5.4075

The output is similar to the outputs of ADF test. If those are found stationary, it means that we have one or more cointegrations. As depicted in the above table, the critical value based on the highest AIC/ SBC value is higher than the t-statistics. So, we cannot reject the null that the residuals are non-stationary. This indicates that there is no cointegration.

This initial result, however, is not intuitively appealing. Moreover, if the variables are not found to be cointegrated, they may still be fractionally cointegrated. In the next step, we have gone for the Johansen cointegration test to verify our result.

TABLE 7: JOHANSEN COINTEGRATION TEST

Criteria	Number of co-integrating vectors
Maximal Eigenvalue	2
Trace	5

In the output of the Johansen test, there are three tables: Maximal Eigenvalue (Table 1), Trace Test (Table 2) and Using Model Selection Criteria (Table 3). Each table contains two columns along with other columns, null and alternative. We start looking from the first row, where $r=0$ (Null: No Cointegration). If T-Statistic < Critical Value, we fail to reject the Null (thus accept it), i.e. no cointegration. However, if T-Statistic > Critical Value, then we reject the Null and move to the next row. There, Null is at least 1 cointegration. Again, if T-Statistic < Critical Value, we fail to reject the Null (accept), i.e. there is at least 1 cointegration, otherwise – move to the next level. We do the same for the other tables.

As depicted in the Table-8, the maximal Eigen value shows two, and Trace indicates that there is five cointegrating vectors. The above results imply that each variable contain information for the prediction of other variables. For example, in our research, we can determine the predicting variable for microfinance as we are examining how macroeconomic variables affect finance and growth in the short and long run.

However, the results conflict with each other in the table above, and it also conflicts with the Engle-Granger test results. As these approaches have many limitations that are well taken care by ARDL, we decided rather to go for ARDL approach for testing cointegration among the variables.

Existence of Long-Run Relationship (Variable Addition Test)

TABLE 8: F-STATISTICS FOR TESTING THE EXISTENCE OF LONG-RUN RELATIONSHIP (VARIABLE ADDITION TEST)

Variables	F-Statistics	Critical value lower	Critical value upper
DGDP	3.7682	2.649	3.805
DINF	3.3464	2.649	3.805
DXR	2.1631	2.649	3.805
DEX	3.5579	2.649	3.805
DMFLA	15.0695*	2.649	3.805
DINT	9.2719*	2.649	3.805

The critical values are taken from Pesaran et al. (2001), unrestricted intercept and no trend with six regressors. * denote rejecting the null at 5 percent level.

The table above shows that the calculated F-statistics for dependent variable MFLA (Microfinance Loans and Advances) is 15.0695, which is higher than the upper bound critical value 3.805 at the 5% significance level. Also the F-statistic for INT (real interest rate) is 9.2719, which is also higher than the critical value 3.805 at 5%. This implies that the null hypothesis of ‘no long-run relationship among the variables’ can be rejected. These results reveal that a long-run relationship exists between microfinance, growth and other controlled variables. The evidence of long run relationship rules out the possibility of any spurious relationship existing between the variables. In other words, there is a theoretical relationship existing between the variables.

At this stage, we run the ARDL test to confirm the short-term and long-term relationship, study long-run coefficients and error-correction model to identify which variables are endogenous and which are exogenous.

Error correction model of ARDL

As discussed earlier, cointegration tells us that there is a long run relationship between the variables. However, there could be a short-run deviation from the long-run equilibrium. Cointegration does not unfold the process of short-run adjustment to bring about the long-run equilibrium. For understanding that adjustment process we need to go to the error-correction model. The T-ratio or the p- value of the error-correction coefficient indicates whether the deviation from equilibrium (represented by the error-correction term, ‘ecm’) has a significant feedback effect or not on the dependent variable. In other word, whether the variable is endogenous or exogenous.

In the following table, the ECM’s representation for the ARDL model is selected with AIC Criterion.

TABLE 9: ERROR CORRECTION MODEL OF ARDL

Variables	Standard Error	P-value
ecm (-1) dLGDP	0.043269	0.485
ecm (-1) dLINF	0.26164	0*
ecm (-1) dLXR	0.07554	0.551
ecm (-1) dLEX	0.30401	0.355
ecm (-1) dLMFLA	0.36419	0.275

Note: * denotes significance at 5 percent level

The Null for this test is that the variable is exogenous, and the alternative is that the variable is endogenous. From the output, we look for the p-value of the ‘ecm’. If it is less than 5%, we reject the null, i.e. the variable is endogenous The error-correction coefficient being significant confirms our earlier findings of a significant long-run cointegrating relationship between the variables. Moreover, the size of the coefficient of the error-correction term indicates the speed of medium to long run adjustment of the dependent variable to bring

about the long run equilibrium. The size of the coefficient of the error-correction term is also indicative of the intensity of the arbitrage activity to bring about the long-run equilibrium.

The error correction coefficient estimated for variable growth (GDP) at -0.030817 (0.043) is highly significant, has the correct sign and implies a slow speed of adjustment to equilibrium after a shock. Finally, the “t” or “p” value of the coefficients of the Δ (i.e., differenced) variables indicate whether the effects of these variables on the dependent variables (i.e., export, inflation, microfinance loans) are significant or not in the short run.

At this stage, we can say that VECM has given a clear picture of short and long run relationship among variables, regarding our research objective. VECM shows that all of our focus variables are exogenous, that is all these variables are impact on other variables, which helps us to argue that there is a dynamic relationship among microfinance and growth. Although the error correction model tends to indicate the endogeneity/exogeneity of a variable, we had to apply the variance decomposition (VDC) technique to discern the relative degree of endogeneity or exogeneity of the variables.

Variance Decompositions (VDC)

In this step, we try to find the relative exogeneity or endogeneity (ranking) of a variable, which can be determined by the proportion of the variance explained by its own past. The variable that is explained mostly by its own shocks (and not by others) is deemed to be the most exogenous of all.

There are two options for VDCs; Generalized or Orthogonalized. Orthogonalized depends on the particular ordering of the variables in the VAR, and assumes that when a particular variable is shocked, all other variables in the system are switched off. Generalized, on the other hand, does not depend on the particular ordering of the variables in the VAR and does not make such an assumption of all other variables switched off.

We have applied generalized VDCs to obtain the following results.

TABLE 10: GENERALIZED VDC

Horizon	Variables	DGDP	DINF	DXR	DEX	DMFLA	Total	Ranking
1	DGDP	41%	0%	34%	5%	19%	100%	3
1	DINF	15%	19%	15%	6%	45%	100%	5
1	DXR	16%	8%	24%	7%	45%	100%	4
1	DEX	6%	4%	17%	51%	23%	100%	1
1	DMFLA	16%	10%	25%	6%	42%	100%	2
Horizon	Variables	LG	LL	LP	LF	INF	Total	Ranking
5	DGDP	20%	12%	28%	4%	36%	100%	3
5	DINF	18%	10%	27%	4%	41%	100%	4
5	DXR	19%	14%	28%	4%	35%	100%	2
5	DEX	19%	12%	27%	5%	37%	100%	5
5	DMFLA	19%	13%	28%	4%	37%	100%	1
Horizon	Variables	LG	LL	LP	LF	INF	Total	Ranking
10	DGDP	18%	9%	25%	6%	42%	100%	3
10	DINF	19%	9%	25%	5%	42%	100%	5
10	DXR	17%	8%	25%	6%	44%	100%	2
10	DEX	16%	7%	23%	9%	45%	100%	4
10	DMFLA	18%	8%	26%	6%	43%	100%	1

From the above table we can see that in the 1-year horizon, export is the most exogenous and inflation is the most endogenous followed by exchange rates. In the 5-year horizon, microfinance is the most exogenous, growth is third most exogenous. In the 10-year term, microfinance is still the most exogenous and growth is the third exogenous.

Comparing with the first period, microfinance takes the lead and remains same in the long run. Impact of exports has decreased slowly over the 10 years period. Growth depends

heavily on exports but dependency declines over the long run while impact of microfinance seems more significant in the long run followed by exchange rates. Dependency of inflation remains constant on growth and other variables over the whole horizon.

The impulse response functions (IRFs) essentially produce the same information as the VDCs, except that they can be presented in graphical form. It tells us about the impact of shock of one variable on others, their degree of response, and how long it would take them to normalize. We expect that if a leading variable is shocked, the response of weak variables will be significant.

Limitations of study and future research

This study has several limitations. This is a single country study that suffers from limited data availability. Moreover, the data is from one microfinance institution only. Annual data was not available for the country level for a minimum 30 annual data points. The study could be expanded to test in various country level and/ or specific regions of the world. The scope of research may also be extended to test the impacts of Islamic microfinance institutions in particular or compare the results of conventional microfinance with that of Islamic microfinance.

Concluding remarks and policy implication

The study finds significant impact of microfinance on the domestic growth (GDP) during our sample period 1983-2013. Even in the long run, after 1-year horizon, microfinance holds the position of first leading variable to create significant impact on growth (GDP). This can be interpreted based on findings of various literatures that microfinance facilitates improved access to finance, which leads to financial inclusion and improves the financial sector, therefore effects positively on the economic growth. In addition to that, the depth of the financial system shapes the structure of the economy in indirect ways and leads to sustainable economic growth and reduce income inequality. So that low-income households that still constitute a majority, have chances to escape from poverty. Moreover, microfinance envisages the integration of the financial needs of households into a country's financial

system and hence is expected to positively affect the growth. Another channel of microfinance impact is through reducing income inequality and poverty; however, such an impact is long-term and thus difficult to measure.

According to our results, growth also has impact on microfinance. This is because, strong financial development and growth facilitates poverty reduction, therefore roles played by microfinance and mainstream finance in tackling poverty is regarded as complementary and overlapping alternatives. As financial sector deepens it also increases its outreach, providing financial services directly to the poor. However, financial development does not touch poor people directly; it nevertheless promotes aggregate economic growth, thus benefiting the poorest in a disproportionately better way. It can thus be concluded that microfinance is an important ingredient in shaping the financial inclusion of the households, thus promoting growth through various channels.

As said herein, a bi-directional finance and growth relationship is found in our study. It can be argued that, finance initially leads the growth, but eventually in the long run, growth actually leads the finance which is supported by similar findings.

For developing countries, this might suggest that the authorities should support the of microfinance institutions by ensuring proper legal and regulatory frameworks and institutions. As part of an interest free economy, Islamic microfinance should be promoted with proper environments, incorporating *qard al-hasan*, *sadaqah*, *zakah*, *waqf* and other appropriate models. For a developed country, the results suggest that the financial development and economic growth is a good indicator that microfinance can flourish thereby.

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