

SENSITIVITY OF LOAN SIZE TO LENDING RATES EVIDENCE FROM GHANA'S MICROFINANCE SECTOR

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Abstract

This study examines the combined effect of interest rates and poverty levels of microfinance clients on loan size. Cross section data on 1800 households (698 clients and 1102 non-clients) from Ghana is used to test the hypothesis of loan price inelasticity. Quantile regression and variants of least squares methods that explore endogeneity are employed. The expected inverse relationship is observed for the poorest specifically, respondents between the 20th to 40th quantile range. Concentrating on different poverty groups of MFI clients, we observe that a change in interest rate leads to varying responses for the demand of loan amount. In view of this, market segmentation based on poverty level is suggested in targeting and sustaining microfinance clients.

Keywords: interest rate, sensitivity, loan, poor, microfinance, Ghana

JEL classification: G20, G29, I30

1. INTRODUCTION

One of the provocative questions in the microfinance sector is on its relatively high interest rates. Albeit microfinance commendation of mitigating wide interest rate variation of about 50 per cent between formal financial institutions and moneylenders, (Armendariz de Aghion and Morduch 2005), spatial differences within the sector have incited concerns. Rosenberg *et al.* (2009) estimate an average interest rate yield of 30 per cent and based on benchmarking analysis concludes that microfinance lending rates are not usurious. However, country-specific high interest rates of 80 per cent per annum evidenced in Mexico and South Africa engender concerns. The concern

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bothers mainly on the effect of lending rates on the economic activities of micro and small entrepreneurs and how they respond in such circumstances. In a related argument, Paranjape (2008) questions the interest rate rigidity of microfinance institutions (MFIs) in an era of low and changing lending rates.

In this study, we propose an approach in determining levels of lending rates based on an assessment of clients' loan size sensitivity to interest rate changes. We argue that the relationship between interest rate and amount of loan is dependent on client's wealth status. While repayment rates in the microfinance sector provide an indication of the poor's response to changes in interest rates, examining the joint effect of the latter and income levels of entrepreneurs on demand for loan size will yield detailed information. This will offer a better understanding of the poor's coping strategy as repayment can either be influenced by the adverse consequences of default or financed from other sources including clients' multiple affiliation with several MFIs (Karlan and Zinman, 2008). In view of data constraints on returns from economic activity, we use the socioeconomic status of borrowers as a proxy variable and argue that the relationship between interest rate and amount of loan take-up is moderated by a client's well-being. This study hypothesizes that clients at the margins of socioeconomic status are sensitive relative to the majority in the middle band. This is partially premised on the positive externality of group mechanism in minimizing information asymmetry amongst the extreme poor. The policy thrust is to explore the much advocated need for market segmentation in microfinance with greater emphasis on clients' socioeconomic status.

The pricing of loan amount theoretically depends on the cost of funds, transaction cost, investment income, and mark-up. However, there are two issues which make a distinct difference in microfinance. First, in view of the adverse effects of subsidies – low loan repayment rates, worsening government fiscal deficit and diversion of credit (Adams, Douglas and Von Pischke, 1984) – MFIs adopt different strategies such as the 'exit approach' in dealing with subsidies (Morduch, 2005). Second, microfinance markets contend with high, volatile, and differential transaction cost in reaching poor clients. While the volatile and high cost can be associated with the poor's characteristics, differences in transaction costs is mainly attributed to variations in MFIs operational strategies. The informal operations of MFIs have partially contributed to the variations in their operational strategies. The strategies leading to variations in transaction costs include: group² vs. individual loans, voluntary and compulsory savings, technological intensity (electronic

² This is premised on the use of social collateral for screening, monitoring and enforcement of repayment in contrast to asset-based collateral.

service devices and mobile phone), branchless (mobile) banking and product mix and others (village banking and so on).

In addition to the transaction costs associated with MFIs' operations, clients of MFIs are burdened with other types of costs. For instance, Rosenberg *et al.* (2009) asserts that the effect of compulsory savings increases the effective cost of the loan to the borrower. Also, the indirect cost associated with 'forced-savings' and frequent repayment rate leads to a variation in nominal or real and effective interest rate. Less obvious, are the time spent during group meetings and other opportunity costs in servicing the loan³. These peculiarities of microfinance constrain the adaptability of mainstream theoretical argument on interest rate and borrowing.

Central to Stiglitz and Weiss's (1981) arguments on demand for credit, rationing, and outcomes are the issues of information asymmetry, interest rate, and collateral. The two outcomes of their work – attracting risky borrowers (adverse selection) and rationing – stumble in the case of microfinance clients. Three reasons can be identified: (1) microfinance clients' economic activities are mostly homogenous and the poor (household with less asset holdings) in terms of investment have been found to be risk averse (Yesuf and Bluffstone, 2009); (2) The argument of client insensitivity, if true, weakens the expected link between interest rate and adverse selection. (3) Non-use of financial and physical asset-based collateral, limits the options of microfinance lenders to enforce rationing which has paved the way for self-risk rationing among clients.

The implausible connection between credit market theory and microfinance practice has led to mixed policy alternatives in determining and understanding interest rates in different economies. Among the different policy options are; interest rate caps, market segmentation based on economic activity, government direct involvement in retail financing, and so forth. Most of these interventions in the past decade have either failed or remain at the experimental phase. The dilemma bothers on the nature of relationship and gradient between interest rate and loan size. The obvious way forward is to revisit the validity of the assumptions characterizing the poor's perceived insensitivity to interest rate charges. This motivation has spurred on some empirical research in the immediate past years. Among these are Briones (2007), Dehejia *et al.* (2005), Dymksi, (2003), Karlan and Zinman (2008), and Karlan *et al.* (2007). An emerging consensus from these studies points to a demystification of the notion of client insensitivity.

The contribution of this study is the use of the entire sample to verify the

³ The interest rate used in this paper fails to account for the additional transaction cost incurred by MFI clients, hence interpretation of the results is mindful of this drawback.

poor's sensitivity in contrast to the use of subsamples as offered in all recent studies cited earlier. Quantile, least squares and two stage estimations are employed in investigating client sensitivity to changes in interest rates. A summary of the main results shows that in contrast to least squares estimation showing a less than unitary downward change in loan size for a small change in interest rate, we observe a pronounced gentle downward slope between the 20th and 40th quantiles. Coupled with this observation are the respective positive and relatively flat curves at the tails and between the 40th and 65th quantiles. Karlan and Zinman's (2008) inclination of the potential effect of poorer clients on the relationship between interest rate and loan size is empirically verified with a multiplicative interactive procedure. Also, we observe that the semi-elasticity of loan amount responsiveness to a unit change in interest rate is more than proportionate (1.78 per cent) and significant with a statistic explaining the distribution of the poorest 20 per cent. In a sharp contrast, the coefficient of interest rate using the 50th percentile is price-inelastic and insignificant.

The study is organized as follows: In the next section, we review the empirical debate on microfinance client insensitivity to interest rates⁴. This is followed by the methods of study and a discussion of the results. We conclude in the final section with some policy recommendations.

2. NON-SENSITIVITY OF INTEREST RATE

Theoretically positing a perfect inelastic demand for credit will lead to market failure at least in the frame of neo-classical economics. Paradoxically, in the microfinance setting this stand-point has dominated for more than two decades. The fact that microfinance is designed for the poor (over time this notion has been qualified to mean 'active' or bankable poor) partially justifies the perceived non-responsiveness to loan amount. That is, due to the dire need for money to survive and other market constraints such as non-competitive market environment and information asymmetry, the cost of borrowing does not inform the decision to access a loan or otherwise. Morduch (2000) prioritizes this view point for the 'win-win' rhetoric. The perception that raising costs of financial service does not diminish demand triggers off a fertile ground for possible consumer abuse. The likely consequence of this in a market-determined system is shifting total transaction cost plus in-

⁴ In an earlier version of the paper, we provide a broader theoretical description of interest rate determination.

efficiency onto the client. The existence of information asymmetry in the market as a result of non-disclosure of loan costs and entire portfolio by micro-lenders also limits the options for the borrower.

Recent empirical studies on client sensitivity (Briones 2007; Dehejia *et al.* 2005; Karlan and Zinman 2008) offer a contrasting outcome to the perceived borrowers insensitivity to changes in interest rate. The most recent study, Karlan and Zinman (2008) use randomized experiments to show that loan size is sensitive at the extensive margin of interest rate changes. This is observed in a hypothetical case of a 100 per cent increase in monthly interest rate. However, they observe that loan maturity is more responsive of loan size than interest rate changes. In line with our main hypothesis, Karlan and Zinman (2008) based on randomized control trial approach, estimate the effects of targeting females and low-income category of clients on a reduced sub-sample. They observe that these groups show much stronger effects of loan size sensitivity to interest changes.

Emerging consensus from the recent studies is sensitivity of microfinance clients. Dehejia *et al.* (2005) and Karlan and Zinman (2008) categorically show that the poor have a much stronger sensitivity. Characteristic of these recent empirical studies is testing the hypothesis on a reduced sample. Though robustness is implied in most of the estimation techniques of the previous studies, compromising reliability as a result of using a reduced sample is inevitable. We are motivated by this to explore the same hypothesis using an alternative empirical method. Instead of estimating the effect of the poor's influence on a reduced sample we integrate poverty characteristics as a variable into the basic model. Quantile regression and interaction procedure in a least squares regression set-up are used to investigate the extent to which average returns (proxied by poverty status) moderates the relationship between loan size take-up and interest rate. Also, as demonstrated by Porteous (2006) the need for a country-specific study that explores institutional differences based on character type and source of funds is imperative.

3. METHODS OF STUDY

3.1 Data sources and structure

Data for the study is based on a survey of client and non-client households in Ghana⁵.

⁵ Data for the study was merged from two Bank of Ghana/World Bank sponsored projects under the broad theme 'Poverty Assessment and a Comparative Study of Rural Microfinance

Based on a nationally representative data, a multi-stage sampling technique was employed by matching lender to borrower for the client sample and a random sampling technique was used to sample the non-client households. A sample of 698 clients (based on those who had ever received a loan) and 1,102 non-client households were used for the analysis. The demographic and poverty patterns of the different groups are provided in the Appendix. Also, details of the sampling procedure are available in the working paper version of this study.

3.2 Poverty score estimation

The study used the Microfinance Poverty Assessment Tool (MPAT) developed by the Consultative Group to Assist the Poor to construct a multidimensional poverty index. Based on the principal component analysis, it combines various welfare variables including housing conditions and characteristics, food security and vulnerability, livestock and consumption assets to calculate a household relative poverty index. The MPAT method, as a measure of relative poverty, has the advantage of collecting cross-sectional data which can be used to construct a multidimensional poverty index (Henry *et al.* 2003). A poverty score of zero hypothetically denotes an average level of poverty, with the higher and lower scores connoting relatively less poor and extreme poor, respectively. Computed household poverty score normally ranges between ± 3 .

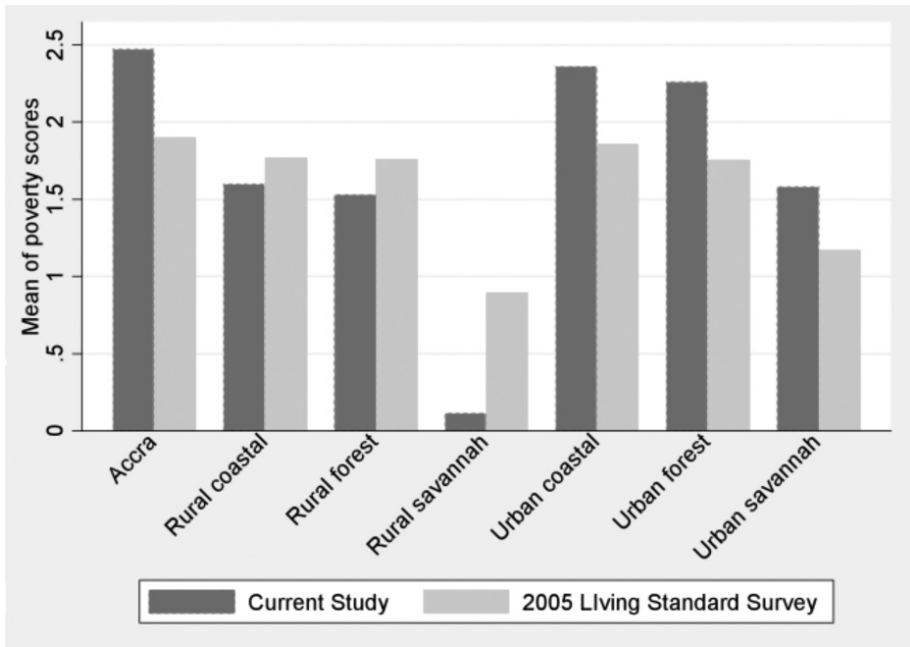
We validate the poverty measure of the current study with the 2005 national living standard measurement survey. Figure 1 shows that similar patterns are observed for the two samples.

3.3 Specification of econometric models

The model specification is consistent with a standard demand for loan amount theory. The a priori expectation of an inverse relationship is explained by the following two plausible transmission mechanisms. The first argument, typical for microfinance operations, asserts that relatively higher costs in administering smaller loans underpin the inverse relationship. In other words, as the loan amount increases per unit, the cost for administering loans reduces. The second reason subscribes to models of consumers' inter-temporal choice that predicts a downward sloping demand curve with respect to price.

Institutions and Government Credit Programmes in Ghana'. The poverty assessment was carried out by the University of Cape Coast in which the author was a member of the core team. The financial performance was executed by Mawuko and Co. Consulting Services.

Figure 1: Data validation



Source: author's compilation

3.3.1 Parametric quantile regression and least squares estimation

Inspired by the restrictions of Gaussian assumptions of linearity and zero conditional mean, Koenker and Basset (1978) prove that for any distribution that the median is a better measure of location, the regression median⁶ is more efficient. In contrast to least squares assuming that the expected value of the error term conditional on the covariates is zero, quantile regression sorts the data and identifies a threshold (τ) to estimate the coefficient (β) that minimizes the sum of absolute residuals. The general set-up of quantile regression, equation (1), is solved from an optimization perspective using linear programming:

$$\hat{\beta}_{(\tau)} = \arg \min_{\beta \in \mathfrak{R}^k} \sum_{i=1}^n \rho_{\tau}(y_i - x_i' \beta) \quad (1)$$

⁶ The proof of the median regression can be easily replicated for other percentiles (quantiles).

where estimated $\beta(\tau)$ called 'tauth' (τ th) regression quantile estimates the coefficient at a specified threshold (τ). τ is the sample quantile and takes on any value between 0 and 1. The expression $\rho_\tau(y_i - x_i'\beta)$, the absolute value function, weights the absolute difference between y_i and $x_i'\beta$ with τ and by $(1 - \tau)$ for all observations below the estimated hyperplane. Koenker and Basset (1978) estimate conditional quantiles using the minimization procedure synonymous to least squares.

3.3.2 Interaction procedure and Second Stage Estimations

The observation of varying interest rate at different percentiles of loan size preempts an investigation of the factors likely to affect the relationship between interest rate and loan size. Karlan and Zinman (2008) identify external factors of targeting females and low income category of clients as potential influences on the relationship between interest rate and loan size. Based on this, we apply the interaction method to least squares and compare our results with the subsamples used in other approaches. The study's hypothesis informs the specification of a functional relationship positing that the effect of interest rate on loan size is moderated by the socioeconomic well-being of the client. This translates into the specification of equation (2).

Jaccard and Turrisi (2003) suggest the need for an initial null hypothesis test to verify the presence of an interaction term in a model. The null hypothesis asserts that the regression coefficient for the product term is zero. Also assessing the strength and nature of the interaction term further justifies the choice statistic to be estimated based on the theoretical and intuitive propositions. The exploratory test uses the basic multiplicative approach to interact the two continuous terms of poverty scores and interest rate in our model. The test for the two equations (with and without the interaction term) indicates an F-value of 30 implying the presence of a statistical interaction between poverty score and interest rate in the loan size equation. In this study, we assume linear⁷ dependence between poverty score and interest rate. We therefore reject the null hypothesis and confirm the assertion of Dehejia *et al.* (2005) and Karlan and Zinman (2008) that the poor moderate the relationship between interest rate and loan size. The strength of the relationship from the multiplicative perspective shows that the interaction effect accounts for 2 per cent of the variance in loan size. Interpreting coefficients in a model with an interactive term, especially in the case of multiplicative interacted

⁷ We are cognizant of the other dimensions of dependence such as varying relationship along the slope and shape culminating into a non-linear relationship between poverty score and interest rate. But for brevity we limit the discussion to a theoretical bilinear relationship.

variables is always received with a pinch of salt. Aiken and West (1990) and Jaccard and Turrissi (2003) both suggest potential problems, notably multicollinearity in interpreting equation (2) given product terms added to the right-hand side variables:

$$LS_i = \beta_0 + \beta_1 Pov_i - \beta_2 Int.r_i + \beta_3 Pov * Int.r_i + \beta_4 X + e_i \quad (2)$$

where LS^8 is the loan amount, Pov is the household poverty score, $Int.r$ is the interest rate, $Pov * Int.r$ is the interaction for the centred variables of household poverty score and interest rate, and X is the vector of other household factors that influence demand for loan amount. Specifying the equation in this form, asserts that the interest-responsiveness of the i th borrower can be inferred from the derivative (equation 3) and the predicted amount of loan size is dependent on the poverty rate of the client (equation 3):

$$\frac{\partial LS_i}{\partial Int.r_i} = -\hat{\beta}_2 + \hat{\beta}_3 Pov \quad (3)$$

Aiken and West (1990) compare uncentred and centred variables in estimated equations and conclude that centred analysis be employed as it facilitates a more intuitive interpretation for interacted variables. With this background of evidence we explore the interaction effect in more detail using specific statistic (mean and different percentiles) of the moderating variable, poverty scores.

We undertake IV and Heckman second stage estimations to correct for plausible endogeneity and selection bias respectively. Though the likely incidence of reverse causality is minimized with a restricted sample of new clients and current amount of loan take-up, endogeneity is still plausible⁹.

4. ECONOMETRIC RESULTS AND DISCUSSION

The econometric discussion is preceded with a summary statistics and correlation matrix in Tables 1a and 1b.

Figure 2 demonstrates concisely the quantile responsiveness of loan size for each of the covariates. For brevity, we restrict our discussion to the main covariate interest rate and factors most likely to influence targeting (poverty and sex of client). The thick dashed line plots the respective least squares coefficient and the light point dots are the confidence intervals.

⁸ The estimation takes the logarithmic form of loan size to calculate semi-elasticity.

⁹ Detailed discussion on the rationale and procedure for the second stage estimation can be found in the working paper version of this paper.

Table 1a: Summary Statistics of variables used for estimation (N= 698)

Variable	Definition/unit of measurement	Mean	SD	Min	Max
Current loan amount	Local currency unit (Ghana)	2311705	5850510	30000	80000000
Number of savings account	Discrete variable	0.862	0.695	0	5
Household size	Discrete variable	5.056	2.531	1	17
Source of funds	= 1 if MFI relies on own funds for operations	0.854	0.353	0	1
Interest rate	Per cent	33.156	7.462	20	48
Previous loan amount	Local currency unit (Ghana)	119214	802138	0	17000000
Sex of client	= 1 if client is female	0.467	0.499	0	1
Poverty score	Continuous variable	0.250	0.987	-2.266	2.396
Location	= 1 Greater Accra or Ashanti Region	0.052	0.221	0	1

Source: author’s compilation.

Figure 2: Least squares and quantile regressions coefficients

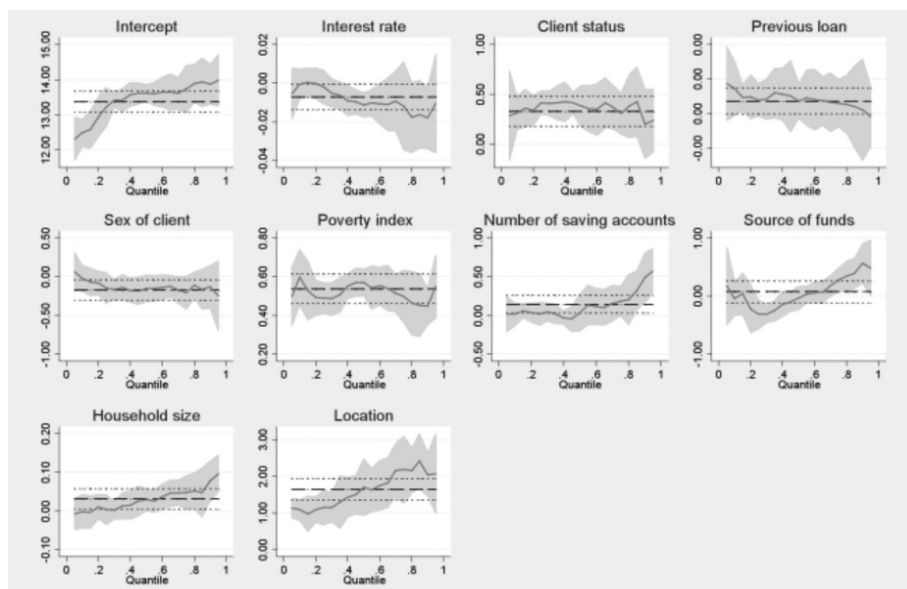


Table 1b: Correlation matrix

Variable	Amount borrowed	Interest rate	Client status	Previous loan amount	Sex of client	Poverty index	Number of savings accounts	Source of funds	Household size	Location
Amount borrowed	1	-0.01	0.17	-0.04	0.08	0.17	0.13	0.06	-0.01	0.29
Interest rate	-0.01	1	0.04	-0.01	-0.03	0.02	0.09	0.17	0.02	-0.08
Client status	0.17	0.04	1	-0.05	0.18	0.15	0.29	0.31	-0.03	-0.17
Previous loan amount	-0.04	-0.01	-0.05	1	-0.08	0.11	0.09	0.13	0.05	0.1
Sex of client	0.08	-0.03	0.18	-0.08	1	0.05	-0.02	0.01	-0.17	0.04
Poverty index	0.17	0.02	0.15	0.11	0.05	1	0.48	0.16	-0.15	0.22
Number of savings accounts	0.13	0.09	0.29	0.09	-0.02	0.48	1	0.24	0.07	-0.01
Source of funds	0.06	0.17	0.31	0.13	0.01	0.16	0.24	1	-0.01	-0.34
Household size	-0.01	0.02	-0.03	0.05	-0.17	-0.15	0.07	-0.01	1	-0.07
Location	0.29	-0.08	-0.17	0.1	0.04	0.22	-0.01	-0.34	-0.07	1
Operational self-sufficiency	-0.12	0.4	-0.11	-0.05	-0.14	-0.51	-0.28	0.08	0.11	-0.15
Self-employed	0.03	-0.01	0.12	-0.1	0.12	-0.37	-0.18	0.02	0.04	-0.17

Source: author's compilation.

The quantile regression coefficients are represented for the various percentiles with the curved lines and respective confidence intervals are shown with the dim background. At a glance, we observe broadly that interest rate, show inconsistent responsiveness of loan size at different quantiles. The least squares show that a marginal upward variation in interest rate results in a 1.4 (more than unitary, see Table 2) downward change in loan size. But the question remains as to whether this is consistent across all the segments of the distribution. Figure 2 shows an inverse relationship for the lower quantiles (up to about 40th), then fairly stable for the middle quantile (between 40th and 65th) and falls further for the higher quantiles.

Sex of client, on the other hand, demonstrates fairly consistent results for both least squares and quantile regression. Column 1 of Table 2 shows that loan size of male clients is 17% higher than female clients. Also, based on the OLS results, Column 1, Table 2, clients from wealthier homes and resident in either Greater Accra or Ashanti region are able to attract higher loan amounts

Table 2: Least squares and quantile regression estimates
Dependent variable: log of current loan size amount

Explanatory variables	Ordinary least squares	Quantile regression thresholds				
		10th	25th	50th	75th	90th
	(1)	(2)	(3)	(4)	(5)	(6)
Interest rate	-0.014 [-3.27]**	-0.004 [-0.71]	-0.006 [-1.26]	-0.018 [-2.81]**	-0.029 [-3.17]**	-0.031 [-2.76]**
Client status	0.315 [4.05]**	0.335 [3.42]**	0.402 [5.07]**	0.349 [3.06]**	0.331 [2.75]**	0.152 [0.85]
Amount of previous loan	0.000 [1.14]	0.000 [1.75]+	0.000 [1.19]	0.000 [1.15]	0.000 [0.64]	0.000 [0.48]
Sex of client	-0.180 [-2.59]**	-0.051 [-0.45]	-0.158 [-1.80]+	-0.135 [-1.53]	-0.112 [-1.24]	-0.162 [-1.30]
Poverty score	0.530 [14.94]**	0.579 [7.82]**	0.467 [10.14]**	0.556 [12.58]**	0.529 [8.50]**	0.478 [5.19]**
Number of savings account	0.146 [1.97]*	0.026 [0.26]	0.043 [0.63]	0.063 [0.51]	0.188 [1.91]+	0.531 [3.75]**
Source of funds	0.136 [1.59]	-0.059 [-0.32]	-0.294 [-2.40]*	0.036 [0.35]	0.325 [3.01]**	0.660 [3.80]**
Household size	0.029 [1.97]*	-0.006 [-0.30]	-0.003 [-0.15]	0.032 [2.04]*	0.056 [2.47]*	0.074 [2.88]**
Location	1.624 [8.06]**	1.120 [6.97]**	1.101 [4.29]**	1.675 [4.71]**	2.011 [5.42]**	1.975 [4.96]**
Constant	13.581 [81.45]**	12.643 [48.96]**	13.379 [53.32]**	13.783 [65.40]**	14.188 [50.89]**	14.234 [41.46]**
N	698	698	698	698	698	698
Adj. (Pseudo) R2	0.473	-	-	-	-	-
Wald-test comparing with 50th percentile	-	F=5.5(0.02)	F=5.10(0.02)	-	F=0.00(0.95)	F=0.68(0.41)

Note: t-statistics in brackets.

- + $p < .10$ (significant at 10%),

* $p < .05$ (significant at 5%),

** $p < .01$ (significant at 1%).

than their counterparts from poorer households and resident in the other eight regions. In terms of client's financial characteristics, we find that possessing a savings account is associated with loan amount.

Based on the observation from the quantile regression and the empirical verification of the presence of an interaction term in Section 3, we hypothesize that client well-being moderates the effect of the relationship between loan size and interest rate. The first column of Table 3 presents the model with the interactive term at the centred predictor, moderator, and their interaction. We opt for centred variables as explained in Section 3 of the study. We estimate this relationship bearing in mind the effect of other covariates, including number of savings account held by the borrower, location, sex of client, household size, and others (see Table 3). The interpretation of the sign and coefficient of the predictor with an interaction generates much complexity depending on the statistic of the moderating variable (Wooldridge 2006). Our initial result at the centred value is to provide an intuitive interpretation of equation (2) at the mean poverty rate. Thus the semi-elasticity of interest rate to loan size is quite marginal (0.2 per cent, relatively inelastic) and insignificant (Table 4, Column 1). This provides an insufficient evidence to reject the null hypothesis of microfinance client insensitivity. This initial result runs parallel to recent studies (Briones 2007; Dehejia *et al.* 2005; Karlan and Zinman 2008) of an elasticity coefficient close to unitary.

Table 3: Interaction effect and reduced samples

Explanatory variables	Interaction term [§]	Poorest sample	Non-poor sample	Impose restrictions	Without interaction term and dummies
	(1)	(2)	(3)	(4)	(5)
Interest rate	-0.023 [-6.06]**	-0.044 [-4.82]**	0.011 [1.92]+	-0.016 [-3.55]**	-0.012 [-2.80]**
Client status	0.268 [3.51]**	0.462 [2.38]*	0.215 [2.53]*	0.242 [3.02]**	0.364 [4.83]**
Previous loan	0.000 [1.86]+	0.000 [0.06]	0.000 [2.23]*	0.000 [3.20]**	0.000 [2.61]**
Sex of client	-0.150 [-2.29]*	0.249 [1.36]	-0.219 [-3.01]**	-0.280 [-3.84]**	-0.151 [-2.26]*
Poverty score	-0.243 [-1.79]+	0.707 [4.22]**	0.427 [6.53]**	- -	0.499 [13.86]**
Number of savings accounts	0.142 [1.97]*	0.137 [0.86]	0.153 [2.04]*	0.284 [3.70]**	0.149 [2.01]*
Source of funds	0.349 [3.88]**	0.428 [1.70]+	0.345 [3.37]**	0.071 [0.79]	0.111 [1.32]

Household size	0.033 [2.30]*	0.106 [4.26]**	0.011 [0.64]	0.010 [0.63]	0.029 [1.95]+
Location	0.553 [2.50]*	Dropped Dropped	0.482 [2.24]*	1.734 [7.40]**	0.653 [3.03]**
Interaction between poverty and Interest rate	0.022 [5.87]**	- -	- -	- -	- -
Interaction between the poverty and location	1.268 [6.11]**	Dropped Dropped	1.294 [6.18]**	- -	1.192 [5.85]**
Dummy for the poorest group	- -	- -	- -	-1.055 [-10.67]**	- -
Constant	13.090 [68.45]**	14.023 [29.43]**	12.813 [54.39]**	14.072 [76.13]**	13.496 [80.00]**
N	698	120	578	698	698
Adj. R2	0.514	0.490	0.361	0.411	0.491
F-Statistic	67.536	31.132	27.249	54.381	58.613
Ramsey's specification test	F = 1.18 (0.316)	F = 2.41 (0.0710) +	F = 3.16 (0.0243) *	F = 8.38 (0.000) **	F = 8.38 (0.000) **
Chow-test	6.14(0.00)				

Note: t-statistics in brackets.

- + p<.10 (significant at 10%),

* p<.05 (significant at 5%),

** p<.01(significant at 1%);

§ - Note that we using the statistic of the bottom 20% for the interaction term.

Table 4: Coefficient of key covariates and interaction at varied statistics

Key covariates	Coefficients at varied statistics [t-values in parenthesis]			
	Mean	20th percentile	50th percentile	80th percentile
Interest rate	-0.004 [-0.98]	-0.023 [-6.06]**	0.007 [1.26]	0.018 [2.58]*
Poverty score	-0.243 [-1.79]+	-0.243 [-1.79]+	-0.243 [-1.79]+	-0.243 [-1.79]+
Interaction	0.022 [5.87]**	0.022 [5.87]**	0.022 [5.87]**	0.022 [5.87]**
Net effect	0.002 ¹⁰	-0.018	-	.023

¹⁰ This value is arrived at by calculating the net effect. That is $di -0.0038217 + [0.0223369 * .2501452]$.

Table 4 compares interest rate at varied statistics and offers a deeper insight as to which category of clients is sensitive. Each percentile of the interaction variable describes a segment of clients' socioeconomic characteristics. The choice for the 20th percentile is informed by the extreme poverty statistics in Ghana and also the evidence of a high coefficient of variation for this group (Table 2). The 50th and 75th were selected due to the basic standardization of these percentiles. Column 3 of Table 4 shows that estimating equation (2) at a value that describes the characteristics of the very poor (20th quantile), the responsiveness of loan size to interest rate changes is more than unitary (2.4 per cent), downward sloping, and significant at less than 1 per cent. The net effect based on Equation 3 yields $[-0.0228431 + (0.0223369 * (.2224695^{11}))] = -0.01787382$ (\approx (1.78 per cent)). That is taking into consideration the moderating effect of clients' well-being of the poorest group, loan size will fall by 1.78 per cent when interest rate increases by 1 per cent. This shows strong responsiveness by the extreme poor and offers consistent finding with earlier studies. However, in each of the other statistics either the coefficient is not significant (mean and 50th percentile) or it shows a positive sign (50th and 75th percentiles).

The significant inverse response of loan size to a unit change in interest rate literally implies that poorer clients' dropout with higher interest rates. This finding might suggest some reasons for the failure of the IGVDG programme in Bangladesh. We are tempted to support the proposition that microfinance is ideal for a particular segment of poor clients normally tagged as 'active' (brave) poor. The labelling of microfinance clients as 'brave' can be interpreted from the perspective of the upper 80 per cent that are non-responsive to interest rate changes. Assuming that non-responsiveness implies repayment, it is utterly important to identify channels of repayment. Among the unconventional means adopted by clients to repay include: multiple borrowing from different institutions and sale of assets. At the extreme, some evidence suggests suicidal tendencies in the long-run when both conventional and unconventional modes for repayment are exhausted (Priyadarshiee and Ghalib, 2011).

Columns 2-5 of Table 3 offer a comparison both within and between the current study's approach and the use of subsamples. Comparing the coefficient of interest rate for the subsample of the bottom 20 per cent with the interaction term of the 20th percentile we observe a consistent sign and significance level. Though in both estimates we observe a more than unitary loan size responsiveness the difference of about 2 per cent is worth considering.

¹¹ This value represents the mean poverty score for the entire sample.

Worth observing from all five columns is a downward sloping demand curve for all estimates but the non-poor sample. The outcome of the positive coefficient is supported by the 50th and 75th percentiles in Table 4.

We empirically test differences in regression slopes across groups. In our context, it is the bottom 20 per cent (Table 3: column 2) vis-à-vis the non-poor sample (Table 3: column 3) compared with a restricted model (Table 3: column 4). The significant Chow-test value of 14.47(0.000) implies the rejection of the null hypothesis that the slopes do not change, if the subsamples are used. This finding upholds the need to formally include a variable capturing the socioeconomic characteristics of the poor into the estimation model instead of estimating subsamples as offered in previous studies.

Table 5 offers second stage estimation results that seek to correct for endogeneity and sample selection problems. In the case of endogeneity, we explore factors that are likely to affect price of loan (interest rate) and not loan amount. First, we use the mean of operational self-sufficiency at the district level to measure microfinance intensity in the district. The intuition is that loan price, like the price of any other commodity is dependent on the intensity of activity of all firms in the market. Second, we argue that clients who belong to groups are able to share information and therefore minimize information asymmetry. That is, clients belonging to group lending mechanism are more likely to make informed decisions about loan price than individual clients. For the sake of brevity, we present results (including validity of instruments) only in the case where district level operational self-sufficiency is used as instrument for loan price. All the post-estimation tests (under identification, weak identification and Hausman) suggest that the instruments are statistically strong and valid. In both cases, – with and without the interaction term (columns 2 and 3) – higher interest rates shows a loan size reducing effect.

Table 5: Second stage instrumental variable and Heckman estimations of loan size Dependent Variable: Amount of current loan

Explanatory variables	Coefficients and robust standard errors				
	(1)	(2)	(3)	(4a)	(4b)
	Least squares	Instrumental variable	Instrumental variable [§]	Heckman 1.	Heckman 2.
Interest rate	-0.014 (0.004)***	-0.069 [-7.83]**	-0.055 [-7.15]**	0.016 (0.005)***	0.013 (0.005)***
Client status	0.314 (0.078)***	0.214 [2.34]*	0.166 [2.06]*	0.044 (0.124)	- 0.014 (0.163)

Number of savings account	0.146 (0.076)**	0.200 [2.43]*	0.164 [2.85]**	0.171 (0.59)***	0.139 (0.58)**
Amount of previous loan	0.000 (0.000)**	0.000 [3.00]**	0.000 [1.57]	0.000 (0.000)***	0.000 (0.000)***
Poverty score	0.530 (0.036)***	0.502 [-4.01]**	-0.626 0.526	(0.038)*** 0.537	(0.039)*** [12.36]**
Location	1.624 (0.205)***	1.547 [8.56]**	0.574 [2.39]*	1.534 (0.150)***	1.692 (0.150)***
Source of funds	0.136 (0.086)	0.522 [4.61]**	0.654 [5.42]**	0.235 (0.105)**	0.019 (0.110)
Household size	0.029 (0.014)**	0.031 [1.85]+	0.035 [2.65]**	0.027 (0.014)**	0.030 (0.014)**
Sex of client	-0.1880 (0.067)***	-0.253 [-3.22]**	-0.188 [-2.81]**	0.297 (0.079)***	0.268 (0.078)***
Poverty *Interest rate	- -	- -	0.034 [7.41]**	- -	- -
Constant	13.581 (0.170)***	15.120 [53.80]**	13.629 [64.51]**	13.867 (0.202)***	14.047 (0.270)***
R-Squared	0.48	0.35	0.48	-	-
Number of obs.	698	698	698	Censored - 850 Uncensored - 698	Censored - 1952 Uncensored - 698
Under Identification Test	-	74.00(0.00)	273.40(0.00)	-	
Weak identification Test	-	200.40(0.00)	441.71(0.00)	-	
Hausman-test	Chi-Square 35.71 (0.00)				
Self-employed [exclusion variable]	0.002 (0.096)				
Heckman – sigma				- 6.49 (0.000)	- 5.74 (0.000)
Heckman – rho				- 2.68 (0.007)	- 2.20 (0.028)
Heckman – test of independence				5.95 (0.014)	3.18 (0.074)

Notes: *** Significant at 1%;

** Significant at 5%

* Significant at 10%;

§ This model estimates an instrumental variable model with an interaction term.

Columns 4a and 4b of Table 5 address the problem of sample selection from two perspectives. The first perspective (column 4a) compares the effect of restricting the sample to only those who accessed loans vis-à-vis other microfinance clients and the second stage compares the former with both clients and non-clients. We propose that self-selection into microfinance programmes and the ability to assess a loan is determined by whether the respondent is self-employed or otherwise. The general belief is that self-employed people self-select themselves into microfinance programmes as non-self-employed respondents are likely to have access to traditional financial institutions and other sources of funds. The sample selection indicator (σ) shows a much higher effect between those who accessed loans and other microfinance clients. The test of independence between the participation and the outcome equations also shows significant results. Although, the variation in interest rate is not huge, it is worth commenting that correcting for selection problems lead to significant changes in other covariates such as client status and source of funds.

CONCLUSION

Achieving financial sustainability and reaching very poor clients concurrently, has been the prime discourse of the microfinance paradigm. The expectation is to provide services to the poor at low effective interest rates. Through this an institution achieves the dual purpose of reaching the poor and providing services on a commercial scale. Behavioural patterns of clients of MFI seem to vary in view of their different socioeconomic well-being. The major conclusion of this study supports recent findings of microfinance client sensitivity to interest rates changes but with a caveat. We say that there are differences in borrower's responsiveness to interest rate changes rather than making a broad claim that microfinance clients are sensitive. First, poorest clients show significant and more than unitary responsiveness to loan amount for a marginal increase in lending rate. Among the main plausible reasons for this observation is the theoretical about the poor's aversion to risk. Second, the dominance of group lending mechanism among the poorest group compared to the non-poor potentially reduces information asymmetry leading to rationale economic behaviour that is, reducing loan amount as interest rate increases. Third, poorer clients are likely to have less resilience to shocks and as such have a higher probability to decline in assessing more loan as its price increases. The non-responsiveness of less poor clients can be

associated with their enthusiastic desire to make a living making them at least risk-neutral if not lovers. While one could surmise other reasons including limited supply of loan market alternatives, this is one area that needs further empirical exploration as part of the process of deepening the outreach of institutions.

The observed upward responsiveness between the second stage IV and the first stage estimations suggests the need to analyse clients' responsiveness from the perspective of their cost rather than institutional nominal interest rates. Cost from clients' perspective reveals the difference between nominal and effective interest rates. Estimating the responsiveness from these two perspectives suggests the ineffectiveness of intervention strategies such as interest rate capping since institutions are able to pass on costs to clients through other channels other than phase value (nominal) interest rates.

Microfinance proponents have argued with the arsenal that the poor are capable of paying back loans with minimal consideration to hurdles encountered during repayment. Although some category of clients may be insensitive to interest rate as observed from the study, theoretical prepositions of adverse implications such as moral hazard and adverse selection threatens the long-term success of reducing poverty and augmenting main stream financial sector. We first subscribe to the recent market segmentation advocacy but propose the use of borrower's responsiveness to complement traditional ways of market segmentation. This will enhance the achievement of client-specific needs to complement location-specific and type of economic activity-driven needs. Second, a 'tested' interventionist approach should be employed in the case of subsidy use. In this light, sensitivity thresholds will always predetermine a likely drop-out. In a comprehensive sense, to prevent the drop-out of poor clients, as experienced from the IGVGD programme in Bangladesh, synergies between financial products, institutional structures, and clients' socioeconomic characteristics should be timely and concurrently administered.

Areas for further work points to the use of extensive datasets to explore bi-causality between loan amount and its price in the case repeated loans. Also, issues of effective interest rate and higher-order interactive terms that include repayment rate, loan schedules, and economic activity will offer in-depth policy direction for practitioners of clients' responsiveness to a blend of strategies.

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Appendix

Demographic and Poverty Characteristics of Households

DEMOGRAPHIC/POVERTY ISSUES	HOUSEHOLDS - (N=2650)		
	CLIENTS (1548)		NON-CLIENTS
	Taken Loan (698)	Not Taken Loan (850)	(1102)
Gender of Household Head			
Female	46.70% - (N=326)	6.12% - (N=52)	24.41% - (N=269)
Male	53.30% - (N=372)	93.88% - (N=798)	75.59% - (N=833)
Settlement			
Rural	44.99% - (N=314)	45.06% - (N=383)	61.62% - (N=679)
Urban	55.01% - (N=384)	54.94% - (N=467)	38.38% - (N=423)
Marital Status of Household Head			
Married	60.46% - (N=422)	96.00% - (N=816)	71.05% - (N=783)
Single	9.89% - (N=69)	1.18% - (N=10)	7.80% - (N=86)
Divorced	16.05% - (N=112)	1.18% - (N=10)	9.71% - (N=107)
Widowed	13.61% - (N=95)	1.65% - (N=14)	11.43% - (N=126)
Highest Education of Household Head			
None	29.37% - (N=205)	34.35% - (N=292)	34.03% - (N=375)
Primary	11.60% - (N=81)	5.65% - (N=48)	10.16% - (N=112)
Junior Secondary School	36.53% - (N=255)	35.18% - (N=299)	37.66% - (N=415)
Senior Secondary School	8.02% - (N=56)	9.76% - (N=83)	7.89% - (N=87)
Vocational	6.30% - (N=44)	4.00% - (N=34)	3.36% - (N=37)
Post-Secondary/Vocational	8.17% - (N=57)	11.06% - (N=94)	6.90% - (N=76)
Occupation of Household Head			
Not Working	1.86% - (N=13)	8.95% - (N=76)	11.16% - (N=123)
Domestic/Casual	1.72% - (N=12)	5.65% - (N=48)	7.26% - (N=80)
Public/Regular	10.03% - (N=70)	20.02% - (N=170)	12.98% - (N=143)
Self employed	86.39% - (N=603)	65.37% - (N=555)	68.60% - (N=756)

Poverty Description			
Mean (SD)		0.217(0.025)	-0.001(0.030)
T-Test		-5.5437(0.00)	
Highest		2.40	2.65
Lowest		-2.49	-3.05
Number of Savings Account			
None	27.51% - (N=192)	38.47% (N=327)	67.70% (N=746)
One	62.18% - (N=434)	45.76% (N=389)	27.50% (N=303)
Two	7.74% - (N=54)	13.06% (N=111)	3.81% (N=42)
Three	1.86% - (N=13)	2.00% (N=17)	0.73% (N=8)
≥ Four	0.72% - (N=5)	0.71% (N=6)	0.27% (N=3)

Résumé

Cette étude examine l'effet combiné des taux d'intérêt et les niveaux de pauvreté des clients de microfinance sur la dimension du prêt. Les données transversales sur 1800 ménages (698 clients et 1102 non-clients) du Ghana sont utilisées pour tester l'hypothèse d'inélasticité des prix du prêt.

La régression par quantile et des variantes de méthodes des moindres carrés qui explorent endogénéité sont employées. La relation inverse attendue est observée pour les plus pauvres en particulier, les répondants entre les quantiles 20-40. Si l'on se concentre sur les groupes différents de clients des IMF, sur la base de la pauvreté, le changement de taux d'intérêt détermine des réponses différentes pour le montant du prêt. Dans cette perspective, la segmentation du marché fondée sur le niveau de pauvreté est suggérée dans le ciblage et le maintien de clients de la microfinance.

Mots-clés: taux d'intérêt, sensibilité, prêt, pauvres, microfinance, Ghana

Classification JEL: G20, G29, I30

