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Sensitivity of Loan Size to Lending Rates

Evidence from Ghana's Microfinance Sector

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Abstract

This paper examines the combined effect of interest rates and poverty levels of microfinance clients on loan size. Cross section data on 2,691 clients and non-clients households 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. We find the expected inverse relationship only for the 20th to 40th quantile range. The semi-elasticity of loan amount responsiveness to a unit change in interest rate is more than proportionate and significant for the poorest group only. 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

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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 some benchmarking analysis conclude 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, 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 in an era of low and changing lending rates. In this paper, 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 clients' socioeconomic status linearly combines with interest rates to determine the amount of loan sort.

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 be financed from other sources including clients' multiple affiliation with several microfinance institutions. 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 paper 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. The first tries to disentangle the role of subsidies that is very much present in microfinance operations. Microfinance practitioners, aware of the effect of subsidies, have either discounted subsidies at the outset or mitigate its effect through an exit approach over time. Either of these approaches is not a familiar practice in traditional banking and evidence of adverse consequences in the microfinance market abound (Morduch 1999a). 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 emerge as a result of variations in operational strategies. The informal operations of microfinance have partially contributed to the occurrence of the latter. The strategies

precipitating variations in transaction cost include: group¹ versus individual loans, voluntary and compulsory savings, technological intensity (electronic service devices and mobile phone), branchless (mobile) banking and product mix. 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 for this: (1) microfinance clients' economic activities are mostly homogenous and the poor in general are risk averse, (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.

The implausible connection between credit market theory and microfinance practice has led to mixed policy alternatives in gauging interest rates in different economies. This includes 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 of the nature of relationship and gradient between interest rate and loan size still remains unresolved with hard evidence. 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), Dymski (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. Very commendably, most of these studies are characterized by rigorous econometric approaches. Econometric tools such as randomized experiments, fixed and random effects, instrumental variable (IV) estimation and Heckman two-stage estimation are used to resolve potential problems of unobserved heterogeneity, endogeneity, and sample selection. Conspicuously missing, however, are the socioeconomic characteristics of clients and how sensitivity varies across different categories of poor borrowers.

We use a quantile approach to justify the application of interaction procedure in least squares to estimate the poor's sensitivity to loan price. Empirical analysis relies on data from Ghana which consists of both clients and non-clients samples. We further explore the robustness of our estimates by addressing potential problems of endogeneity and sample selection using traditional second stage methods of IV and 'Heckman' estimations. The contribution of this paper is the use of the entire sample to verify the poor's sensitivity in contrast to the use of subsamples as offered in all recent papers cited earlier. The estimation procedure is done as follows: in the first stage we estimate a quantile regression of a basic loan size equation at different percentiles to assess

¹ This is premised on the use of social collateral for screening, monitoring and enforcement of repayment in contrast to asset-based collateral.

variations in responsiveness for all covariates especially interest rate. The second stage employs the interaction procedure for household poverty scores and lending rates at varied statistics to identify differences in clients' responsiveness. Finally, we compare our results with a subsample approach, test and correct for problems of endogeneity and sample selection.

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. Subsequently, we show 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 next two sections of the paper discuss the theoretical debates and some recent empirical findings on the determinants and levels of interest rate and client sensitivity. They draw on some of the main issues indebted to interest rate fixing and relate that to arguments for and against a market-driven competitive microfinance industry. Macro-level factors such as prime rate and general macroeconomic environment are perceived as exogenous to the focus of this paper and therefore are not discussed. These sections will be followed by a brief description of the microfinance industry in Ghana. Sections 5 and 6 discuss the methods of study and results respectively. The final section concludes and identifies two core policy issues emerging from the discussion and analysis.

2 Interest rates

The analysis of the McKinnon and Shaw hypothesis sets the tone for financial sector deregulation in most countries (McKinnon 1973; Shaw 1973). Since then, interest rate determination in formal financial institutions has experienced a transition from various forms of direct regulation to a system deregulation. The latter permits the market through the demand and supply of loans to determine rates. The principal justification for the turnaround is the plausibility of financial repression in a regulated regime. Black et al. (1997) posit that denying financial service providers the opportunity to charge interest rates at the market equilibrium leads to spiral shortages as potential lenders are sidelined due to government direct involvement in retail financing. Thus regulating interest rates through diverse means such as caps, high bank reserve, and liquidity ratio requirements discourage innovation and diversification of loan products.

Notwithstanding this viewpoint, although strongly upheld, Levine et al. (2000) identify broad financial functional roles of the state² to mitigate some lapses that emerge as a

² This includes legal frameworks for contract enforcement and broad accounting and reporting standards.

result of market determination of interest rate. Permitting credit markets to determine interest rate through the economic forces of demand and supply of loans leads to rationing as a result of imperfect information (Stiglitz and Weiss 1981). Stiglitz and Weiss (ibid.) argue from the perspective of a pool of borrowers that react to interest rate and collateral set by banks. The riskiness of projects and attitudes of borrowers constrain banks to continuously increase interest rates and collateral requirements even in the case of an excess demand for loan. The obvious consequences of adverse selection and moral hazard stare in the face of banks. Over time banks have developed other mechanisms to mitigate these potential problems. For instance during all three³ principal phases of a loan life, non-asset based strategies⁴ are employed to minimize loan default, fungibility, and to stimulate and redirect investment to prioritized sectors of an economy.

With this backdrop of information on the state of play in the traditional banking system an open question about the applicability of this theory and practice to microfinance markets remains unanswered. The starting point for any discussion is to acknowledge that the market for microfinance is a residual of the traditional banking market. The philosophy underpinning the emergence of microfinance was to serve the neglected market niche of the traditional banking system. This market niche, though hard to define, in practice has been labelled with different names. This includes the ‘unbankable’, poor, brave poor, economically active poor, and so forth. A plausible reason for the different labelling overtime is the ongoing identification of a group of clients capable of responding favourably to banking needs and services. Operational strategies of making loans to the poor adds to the difficulty of finding an ‘ideal’ group of clients that hitherto had been neglected by traditional banks but viewed as ‘bankable’ clients in microfinance. Practices, such as group lending, joint liability, receipt of subsidies, grants and government direct intervention, small and frequent loan repayments, forced savings, maintenance of a minimum balance of savings throughout the loan life and incorporating other non-financial services complicates the adaptation of banking theory to suit microfinance. These issues directly or indirectly affect the core factors of determining an interest rate that is loan loss, transaction cost, and mark-up. In addition to these factors, administrative cost efficiency and competition also affect interest rates. For the sake of brevity we discuss two issues (transaction cost and subsidies) that make interest rates setting a peculiar issue in the case of microfinance.

2.1 Transaction cost

The pricing of microfinance services like any other good or service is a function of transaction cost. Transaction cost in the delivery of financial services, basically has three components: the costs of funds for on-lending, the costs of risk (loan loss), and administrative costs (processing loan applications, educating or training of clients and monitoring for loan repayment).⁵ The above makes it imperative to reach the conclusion

³ Screening, monitoring, and enforcement.

⁴ The non-asset based strategies include credit history, submission and assessment of business plans and their viability, and other demographic and communal records.

⁵ It is important to acknowledge the non-quantifiable component of transaction costs incurred by borrowers. This includes waiting time with or at bank premises, transportation cost, and cost of delay in receiving loans.

that the absolute transaction cost per head of a poor person is more expensive than a client of a formal financial institution.

Received wisdom has long been that, lending to poor households is not worth it, due to too high costs, too great risks, too low saving propensities, and too few households capable of putting up collateral (Morduch 1999b). The likely consequences of these adverse characteristics have been dealt with through alternative mechanisms such as group lending and joint liability, forced savings and small and regular loans and repayment. These mechanisms seem to prove that microfinance can be sustainable. In spite of the ingenuity of delegated screening, monitoring and enforcement, transaction costs are up the roof and used as the main argument for high interest rates. Obvious reasons are the other strategies of microfinance operations including small amounts of loans and forced savings, remote settlements and provision of non-financial services. For instance, Rosenberg et al. (2009) assert that the effect of compulsory savings increases the effective cost of the loan to the borrower.

In microfinance, cost components of animating groups, purchase of forms, implications of 'forced savings' and frequent repayment rate constitutes the difference between real and effective interest rate. The precise magnitude of the difference is unknown but anecdotal evidence points to a more than 100 per cent gap. Less obvious, but added to this cost component, is time spent and opportunity cost in servicing the loan. In the case of poor clients this is high due to the inclusion of non-financial services as loan beneficiaries spend more time with bank staff. Finally, non-use of high technological devices such as computerized operations increases per unit cost.

2.2 Subsidies

Poverty reduction through subsidized credit was the centrepiece of development strategies of many countries from the early 1950s through to the 1980s. Available evidence suggests that the strategy failed for a number of reasons. This includes low loan repayment rates which dropped to below 50 per cent in some cases, increased costs to donors and worsening government fiscal deficit and diversion of credit from intended recipients to political favourites (Adams et al. 1984). The justification for its reemergence is the balance between social and economic objectives of microfinance. For instance, the Income Generation for Vulnerable Group Development (IGVGD) run by the Bangladesh Rural Advancement Committee (BRAC) targets the destitute and as such has a strong inclination for its social mission. The compelling advocacy of the financial systems approach provides a counter-argument on the impact of subsidies.

The strategy, abandoned some years ago, has reemerged in microfinance with much harder questions of extent, nature, and time of subsidy utilization as against the either/or argument of subsidy. The current debate departs from the extremes and asserts the need on some form of subsidy, packaged in an 'ideal' manner and delivered to the 'right' beneficiary at the 'right' time. Open fields will always remain in an attempt to provide responses to these questions. For instance, amount and time of subsidy depends on peculiar characteristics of both institutions and its clients and the extent of competition and/or influence of the immediate environment. Armendariz de Aghion and Morduch, (2005) posit that the amount of subsidy depends on factors including sensitivity of credit demand to interest rates, adjustment time between increases in income and well-

being, returns to investment by poorer households, and negative externality of subsidized credit programmes to other lenders.

The debate is further stretched on who receives the subsidy. For instance, directing subsidies to institutional strengthening of which clients at the outset will pay full recovery rate but indirectly benefit from structures such as credit bureaus that smoothens the delivery of financial services. From a more pragmatic perspective some institutions have rolled out client sourcing of subsidies over time and product. This allows for institutions to offer some non-financial services such as food aid, health, and education at subsidized rate and latter or concurrently role-out commercial lending rate schemes. Though applauded for its relatively better intuitiveness the IGVGD programme of BRAC experienced a massive drop-out with clients that benefited for this intervention. Also closely related to this type of intervention is the emergence of cross-subsidy that segments the markets and discriminates in the pricing of loan. Segmentation has principally depended on the economic activity, repeated loans, repayment, and sometimes perceived average returns of the economic activity. These have been conceived from a theoretical perspective but most microfinance institutions grapple with its implementation. The main problem is attributable to lack of a thorough understanding of client responsiveness to pricing of loan.

3 Non-sensitivity of interest rate

Theoretically positing a perfect inelastic demand for credit will lead to market failure at least in the frame of neoclassical economics. Paradoxically, in the microfinance setting this stand-point has dominated for more than two decades. The perception that microfinance is designed for the poor who live on the fringes of survival partially justifies the 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 services 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 inefficiency onto the client. The existence of information asymmetry in the market as a result of non-disclosure of loan costs and entire portfolio by microlenders also limits the options for the borrower.

Generally, the ability to repay has been used as the benchmark for the success of microfinance programmes. What is not discussed are the strategies used for repayment and whether these translate positively to increased consumption and income and eventually well-being. Anecdotal evidence points to a situation where at the time of repayment, some household assets are sold out of distress. The adverse effect of this phenomenon is the creation of a vicious cycle of poverty. Karlan and Zinman (2008) related to the above assert that clients scout around and borrow from other sources to repay loans.

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) uses 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 (ibid.) estimate the effects of targeting females and low-income clients on a reduced subsample. 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.

4 Microfinance industry in Ghana

In Ghana, the practice of sourcing funds from non-formal financial institutions dates back to 1955 when the Canadian Catholic Missionaries established the first credit union in northern Ghana. The concept was expanded at the beginning of the 1970s with the establishment of the first rural bank at Nyakrom. Since the activities of such institutions were not considered as part of mainstream financial sector, their contribution to financial deepening was neither documented nor recognized until the latter part of the 1990s when issues of poverty reduction became part of the developmental agenda. The shift from growth-led strategies to poverty reduction strategies provided an avenue for pro-poor policies and programmes. Recognizing access to credit as a major constraint to the promotion of pro-poor activities, a number of institutions (governmental and non-governmental) emerged to provide financial services to the poor.

In 1996, a number of groups involved in implementing micro-financing projects came together to form the Microfinance Action Research Network. The aim was to play an active role in policy discussion, formulation, and implementation of programmes related to micro-financing in the country. In 1998, the group changed its name to the Ghana Microfinance Institutions Network (GHAMFIN). The main objectives are to: strengthen the capacity of microfinance institutes (MFIs) through training, sensitize government and stakeholders, contribute to the creation of employment opportunities, and the provision of support and empowerment to the poor and excluded.

At the governmental level a number of ministries, departments and agencies (MDA) have established desks or units for microfinance activities. Among the MDA with microfinance programmes are the Ministry of Finance and Economic Planning, the Office of the Senior Minister, the Ministry for Women and Children Affairs, the Bank

of Ghana, and the Ministry of Local Government, Rural Development, and Environment. To co-ordinate and streamline activities of the industry, a central body, known as the Microfinance and Small Loans Centre was established in 2006. Its mandate is to co-ordinate all microfinance activities in the country especially government programmes and complement the activities of other microfinance apex bodies.

The number of microfinance implementing institutions cuts across both formal and informal organizations. Five broad categories of institutions provide financial and technical services in the industry. These institutions are rural and community banks, savings and loans companies, financial non-governmental organizations (FNGOs), credit unions and the Susu Collectors Association of Ghana. All these institutions have created their apex bodies and are spread in all the ten regions of the country.

In addition, some formal banks and insurance companies have linked up either with some existing microfinance institution or created a microfinance department. The heightened interest and concerns of microfinance activities in Ghana drive the exploration of complementary services and signals the need for market growth towards competition. Perceived availability of effective demand for financial services partly explains stakeholders' sustained interest and concerns.

5 Methods of study

5.1 Data sources

Data for the study is based on a survey of client and non-client households in Ghana.⁶ For the survey, the country was divided into the northern zone, consisting of the upper west, upper east and northern regions, the middle zone made up of the Brong Ahafo, Ashanti, the eastern regions, and the coastal zone covering the Volta, Greater Accra, the central and western regions. Based on assessment of microfinance institutions by ARB Apex Bank, Credit Union Association, and GHAMFIN on the activities and the performance of their members, 16 institutions were selected from the three zones. In addition, an institution using *susu*⁷ methodology to mobilize funds was selected, giving a total of 17 microfinance institutions. Clients of selected microfinance institutions were randomly selected and their households identified for the study.

Clients of four rural banks, one credit union and two FNGOs, were selected from the coastal zone. In the middle zone, two rural banks, one credit union, and one FNGO were selected, and clients of three rural banks and one FNGO were selected in the northern

⁶ 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 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.

⁷ This is small and very regular cash deposits made by individuals to a trusted person of which withdrawals can be made at anytime but subject to a proportional fee that is based on the duration of transaction.

zone. The 17 institutions provided funds from their own resources, or the government channelled through either the district assembly or a Ministry and donor sources such as the International Fund for Agricultural Development, the World Bank, and other bilateral agencies.

To facilitate the test for sample selection effect, data on non-client households was assessed from the same study. From national representative data on 1,102 non-clients, households were randomly interviewed based on the framework of the Ghana population census.

Data collected included sociodemographic and economic profile of clients' household, economic activities, employment history, and institutional level indicators such as sources of finance and interest rates paid. Selected respondents were clients who had received loans for the first time within the last six months prior to the survey, or had been processed for loan.

The total sample size for the study is 2,691 units—1,589 clients and 1,102 non-clients households were available for analysis. The sample varied at different stages of the analysis. For instance, based on institutional mandatory limitations on the loans mobilization clients of one of the five main categories were excluded in the final analysis. The mandate of susu,⁸ like FNGOs are restricted in receiving deposits. But in the case of FNGOs some linkages with other financial institutions have permitted them to engage in receipt and dispensation of financial services. Steel and Aryeteey (1994) caution on the exclusivity of susu operations. Also Steel and Andah (2003) categorize individual susu collectors as informal. The final dataset for the analysis was based on respondents from rural banks, credit unions, savings and loan companies, and financial non-governmental organizations. The analysis was restricted to clients of institutions that had received loan amount within the six months period prior to data collection. A potential demise of this approach is a sample selection bias which has been addressed in this paper. A total of 698 client households were analysed. However, exploratory and robustness check required an additional dataset. The quantile regression estimation is based on a larger sample of 720 clients which includes respondents paying back only the principal amount. Also robustness check for sample selection problems required inclusion of non-client samples making the total sample 2,650 (698+1,102).

5.2 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

⁸ Quite recently, Barclays Bank, one of the biggest commercial banks in Ghana, has initiated a product that fosters collaboration with susu companies. Among the principal objectives is to increase the scale of operation which implies exploration of deposit taking opportunities. Anecdotal evidence suggests that this has led to an increased cost of operation and subsequently interest rates.

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. This meant that an institution with a better depth of outreach will have scores averaging lower than zero while institutions reaching less poor clients will have an average value greater than zero. Computed household poverty score normally ranges between ± 3 . Poverty scores for clients of selected microfinance institutions ranged from -1.515 (reaching the poor, better outreach) to 1.204 (reaching the less poor) with a mean poverty score of 0.2847. On average, all the institutions were reaching less poor clients. See Table 1 for the variables that emerged finally for the computation of household poverty scores.

For comparison, Figure 1 categorizes client respondents into five groups. Household indices are arranged in ascending order and classified into quintiles. In this sense the MPAT is applied in a comparative context by categorizing respondents into groups. This approach permits ranking poverty groups from extreme poor to non-poor. As evidenced in Figure 1, the cut-off for extreme poor category (bottom 20 per cent) is -0.81.

The choice of quintile classifications over other cluster options is informed by the recent outcome of the category of extreme poor households in Ghana. Ghana Statistical Service (2007) shows a national extreme head count poverty of one out every five persons. This benchmark is important for validation and consistent policy direction.

We validate the poverty measure of the current study with the 2005 national living standard measurement survey. Comparing the patterns of poverty for these two datasets across administrative regions of the country, we observe a 91 per cent degree of association. Also similar patterns of poverty were observed based on broad rural/urban classification and ecological zones (Figure 2). In spite of the validation check, caution in interpreting the results is required due to the usual constraints in using indices and more particularly in the context of poverty which is multidimensional.

5.3 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' intertemporal choice that predicts a downward sloping demand curve with respect to price.

5.3.1 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 median⁹ is more efficient. In contrast to least

⁹ The proof of the median regression can be easily replicated for other percentiles (quantiles).

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:

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

where estimated $\hat{\beta}_{(\tau)}$ 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 Bassett (1978) estimate conditional quantiles using the minimization procedure synonymous to least squares.

5.3.2 Interaction procedure

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 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 paper, we assume linear¹⁰ 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 variables is always received with a pinch of salt. Aiken and

¹⁰ 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.

West (1990) and Jaccard and Turrisi (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_i 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):

$$\frac{\partial LS_i}{\partial Int.r_i} = -\beta_2 + \beta_3 Pov \quad (3)$$

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.

5.3.3 Second stage estimations

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 plausible. Multiple sources of endogeneity including omitted variables are likely to bias our estimates. Specific to this paper, institutional features that complement the effect of interest rate on loan size is likely to affect our equation via an omitted variable perspective. Typically, one can argue that institutional performance can cause interest rate endogeneity. Identifying operational self-sufficiency¹² as an instrument for interest rate and measure of institutional performance we address the two pronged requirements for the use of IV. The initial testable requirement shows that the correlation between interest rate and operational self-sufficiency is 0.40. The second prerequisite which requires intuition and theory points to a minimal association between operational self-sufficiency and the error term of the loan size equation. We argue that due to an institution's risk perception of first and repeated loans¹³ restricting the sample to new clients nullifies the plausible effect of

¹¹ The estimation takes the logarithmic form of loan size to calculate semi-elasticity.

¹² Operational self-sufficiency is measured as financial revenue (financial expense + net loan loss provision expense + operating expense). The unadjusted subsidy effect explains the effect of donors and government in amount of loan disbursed.

¹³ Anecdote suggests that microfinance institutions use donor and government grants mostly for first time loans and as such are not very particular about its effect on the sustainability of their operations.

institutional performance on amount of loan disbursed. In view of the above, we propose that the interest rate coefficient is biased downwards as a result of the inverse relationship between the instrument and loan size on one hand and positive relationship between interest rate and operational self-sufficiency on the other hand.

In the case of sample effect, Armendariz de Aghion and Morduch (2005) point out that impact studies in microfinance are decidedly mixed as a result of methodological issues including selection bias. We correct for sample problems that emerge on the premise of (a) the probability of an individual participating in a microfinance programme and (b) the likelihood of being a member and accessing a loan. Identifying an exclusive variable for the participation equation is always daunting, given the demise of a trade-off in the efficiency of our results. The potential of huge standard errors in second stage estimation is verified by comparing our results with least squares. Occupational category of respondent that is either self-employed or otherwise is used as the exclusive variable. The choice of this variable is rationalized by the preponderance of self-employed entrepreneurs in microfinance.

We therefore estimate an outcome equation as:

$$LS_i | x_i ; Cl_i = 1 = \alpha_1 X_{1i} + \sigma_{12} \hat{\tau}_i (\hat{z}_{4i} \gamma_4) + \eta_i \quad (4)$$

where σ_{12} denotes the error term emerging from the participation and outcome equations, $(\hat{z}_{4i} \gamma_4)$ is the variable representing inverse mills ratio (IMR) for each of the observed households computed from a participation equation; τ is the coefficient of the IMR and η_i is the normal stochastic term for an ordinary least square and X is the vector of covariates in our outcome equation.

Finally, to compare our approach to that of previous studies, we estimate the interest rate effect on two subsamples. Equations (5) and (6) specify the estimation of two subsamples [poorest sample (bottom 20 per cent) and non-poor sample (upper 80 per cent)]. Categorization of the sample into quintiles and the exploratory outcome of the box and whisker plot informed the specification of the two broad regressions. As observed, the variability between the poorest 20 per cent and the other group is both economically and statistically significant.¹⁴ Equation (7) estimates a restricted model that includes a dummy to capture the effect of poverty.

Poorest sample:

$$LS_i = \beta_0 + \beta_1 Pov_i - \beta_2 Int.r_i + \beta_4 X + e_i \quad (5)$$

Otherwise sample:

$$LS_i = \beta_0 + \beta_1 Pov_i - \beta_2 Int.r_i + \beta_4 X + e_i \quad (6)$$

¹⁴ Calculated t-value for the difference in average interest rate between the bottom 20 per cent and the upper 80 per cent is 4.5, denoting statistical significance of the variation for the two groups.

Unrestricted model:

$$LS_i = \beta_0 + \beta_1 Pov_i - \beta_2 Int.r_i + \beta_4 X + \beta_5 Non - poor_i + e_i \quad (7)$$

We apply the traditional Chow-test¹⁵ to examine consistency in slope coefficients between the unrestricted—equations (5) and (6)—and the restricted (equation 7) models. Equations (4) and (5) are tested concurrently against the restricted model of equation (7). Though robust estimation to a large extent has been meticulously considered at different stages of this study we are humble in asserting a definite uncausality from interest rate to loan size due to the cross-sectional nature of our dataset.

6 Results and discussion

The econometric results are preceded with the descriptive statistics. Tables 2 and 3 provide a detailed description of differences in interest rates across institutions and correlation between the variables. Figure 3, shows the variation in interest rates by different poverty levels of clients.

6.1 Econometric results

Figure 4 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, gender of client). The thick dashed line plots the respective least squares coefficient and the light point dots are the confidence intervals. 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 rates show inconsistent responsiveness of loan size at different quantiles. The least squares show that marginal upward variation in interest rate results in a 0.7 (less than unitary, see Table 4) downward change in loan size. But the question remains as to whether this is consistent across all the segments of the distribution. The quantile regression shows that the change is much higher for the lower quantile (up to about 40th), fairly stable for the middle quantile (between 40th and 65th) and falls further for the higher quantiles.

Gender of client, on the other hand, demonstrates fairly consistent results for both least squares and quantile regression. The only observable variation is at the lower quantile of a difference between male and female clients higher than 17 per cent. With both covariates, the respective 5 per cent significance level observed from the least squares, is not consistent across the quantiles (Table 4). The inconsistency incites probes into the resilience and reliability of the least squares estimates. We address these probes by exploring the interaction effect and checking for robustness using second stage estimation techniques.

¹⁵ The Chow-test, like any other F-test, tests the hypothesis of equal slopes in the different subsamples, see Wooldridge (2006).

Based on the observation from the quantile regression and the empirical verification of the presence of an interaction term in Section 4, we hypothesize that client well-being moderates the effect of the relationship between loan size and interest rate. The first column of Table 5 presents the model with the interactive term at the centred predictor, moderator, and their interaction. We opt for centred variables as explained in Section 4 of the paper. We estimate this relationship bearing in mind the effect of other covariates, including number of savings account held by the borrower, location, gender of client, household size, and others (see Table 5). 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. 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 6 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 6 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 $[-0.0228431 + (0.0223369 * (.2224695^{16}))] = -0.01787382$ (\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 drop out with higher interest rates. This finding might suggest some reasons for the failure of the IGVGD programme in Bangladesh. We are tempted to support the proposition that microfinance is ideal for a particular segment of poor clients normally tagged as '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. Some anecdotal evidence suggests suicidal tendencies in the long-run when both conventional and unconventional modes for repayment are exhausted.

¹⁶ This value represents the mean poverty score for the entire sample.

Columns 2–5 of Table 5 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. 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 6.

We estimate equations (5) to (7) to empirically test differences in regression slopes across groups. In our context, it is the bottom 20 per cent (Table 5: column 2) vis-à-vis the non-poor sample (Table 5: column 3) compared with the restricted model (Table 5: 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 used do. 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 7 offers second stage estimation results that seek to correct for endogeneity and sample selection problems. Correcting for endogeneity, we observe that the interest rate coefficient increases by a margin of 0.06. The use of operational self-sufficiency which is positively correlated with nominal interest rate and inversely related with loan size resolves the plausible underestimation. This suggests that using effective interest rate is likely to show greater responsiveness relative to nominal interest rate. The Hausman test shows that the IV coefficients are better in spite of the huge standard errors.

Columns 4a and 4b of Table 7 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 assessed to traditional financial institutions and other sources of funds. The sample selection indicator (σ) shows a much higher effect between those whose assessed 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.

7 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 strong caveat. We assert the variability of borrower's responsiveness to interest rate in contrast to ascribing generic sensitivity for all microfinance clients. 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 knowledge of the poor's aversion. 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 of 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 ('brave poor'), making them at least risk-neutral. 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 client responsiveness from the perspective of their cost rather than institutional nominal interest rates. Cost from the perspective of clients 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 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 propositions of adverse implications such as moral hazard and adverse selection roars at the long-term success of reducing poverty and augmenting main stream financial sector. We first subscribe to recent market segmentation advocacy but propose the use of borrowers' responsiveness to complement traditional client differentiation methods including type of economic activity and community level indicators. This will enhance the achievement of client-specific needs to complement location-specific and type of economic activity-driven needs. Second, a broader 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 point 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 client responsiveness to a blend of strategies.

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Table 1: Variables used in constructing poverty index

Components	Indicators
Geographical location	Urban or rural location in rural savannah
Food Security and vulnerability	Coping strategy: frequency of reducing number of meals
Quality of the house	Index for type of ownership, access to water, electricity, quality of roof, walls toilets, etc.
Assets of the HH	Motorcycle, bicycle, TV, stereo, radio, fridge, stove, sewing machine, fan, iron, etc.
Access to basic needs	Time (in minutes) to the nearest secondary school and pharmacist.
Education	Literacy and level of schooling of HH head, per cent of adults who have completed primary schooling, ratio of literate adults
Occupation	Number of adults self-employed in food crop agriculture and distance to the nearest food market.
Expenditures	Clothing and footwear expenditures per person.

Source: Awusabo-Asare et al. (2009).

Table 2a: Loan amount by poverty quintiles

Poverty groups	N	Mean	Max	Min	Median
Extreme poor	120	¢45,628 US\$5.06	> ¢2,000,000 US\$221.78	¢30,000 US\$3.33	¢335,000 US\$37.15
Very poor	153	¢1,284,999 US\$142.49	> ¢10,000,000 US\$1,108.89	¢50,000 US\$5.54	¢1,000,000 US\$110.89
Poor	155	¢1,511,087 US\$167.56	> ¢10,000,000 US\$1,108.89	¢100,000 US\$11.09	¢1,000,000 US\$110.89
Moderately poor	124	¢2,271,049 US\$251.84	> ¢40,000,000 US\$4,435.57	¢100,000 US\$11.09	¢1,000,000 US\$110.89
Non-poor	146	¢5,805,849 US\$643.81	> ¢80,000,000 US\$8,875.17	¢100,000 US\$11.09	¢2,000,000 US\$221.78
Total	698	¢2,313,587 US\$256.55	> ¢80,000,000 US\$8,871.15	¢30,000 US\$3.33	¢1,000,000 US\$110.89

Source: Author's compilation.

Table 2b: Interest rate by poverty quintile

Poverty quintiles	N	Mean	P5	P25	P50	P75	P95	Coefficient of variation
Extreme poor	317	30.49	20	20	28	35	48	0.324
Very poor	320	30.68	0	25	35	36	42	0.213
Poor	318	32.52	20	30	35	37	42	0.183
Moderately poor	317	33.06	20	30	35	37	42	0.188
Non-poor	317	33.60	20	30	35	37	42	0.162
Total	1589	32.07	20	28	35	37	48	0.220

Source: Author's compilation.

Table 3a: Poverty scores and interest rate charged by institution and programme

MFI	Source of funds	Interest rate per	Poverty Score
CU1	Deposits	25	1.057
RB2	Deposits	28	-1.513
	Donor	25	-1.515
RB3	Deposits	35	-0.722
FNGO1	Donor	48	-1.187
FNGO2	Donor	35	0.924
	Deposits	35	0.924
S & L	Deposits	7	1.204
RB4	Deposits	36	0.503
	Government	36	0.274
FNGO2	Deposit	25	0.238
RB5	Deposits	35	0.023
	Government	0	0.665
RB6	Deposits	42	0.767
RB7	Government	20	-1.374
	Donor	20	-1.097
RB8	Government	20	0.797
	Deposit	34	0.561
RB9	Deposit	30	0.709
	Deposit	30	0.974
	Government	20	0.555
	Government	20	0.365
CU2	Deposit	36	1.167
	Ashanti Deposit	37	0.483
FNGO3	Volta Deposit	37	1.057
	Eastern Deposit	37	0.957
	Brong Deposit	37	0.642
SUSU	Deposit	-	1.226

Source: Author's compilation.

Table 3b: Summary statistics

Variables	Definition/unit of measurement	N	Mean	SD	Min	Max
Current loan amount	Local currency unit (Ghana)	1589	1032291	4044590	0	80000000
Interest rate	Per cent	1589	32.06734	8.842656	0	48
Client status	=1 if client receives multiple financial service	1589	0.254248	0.435575	0	1
Previous loan amount	Local currency unit (Ghana)	1589	773851.5	3088975	0	70000000
Gender of client	=1 if client is female	1589	0.246067	0.430854	0	1
Poverty score	Continuous variable	1589	0.216987	1.002145	-2.5	2.40
Number of savings account	Discrete variable	1589	0.826935	0.757584	0	6
Source of funds	= if MFI relies on own funds for operations	1589	0.877281	0.328217	0	1
Household size	Discrete variable	1589	5.334802	2.316827	1	17
Location	= 1 if client is resident in either Greater Accra or Ashanti Region	1589	0.050346	0.218727	0	1

Source: Author's compilation.

Table 3c: Correlation matrix

Variable	Amount borrowed	Interest rate	Client status	Previous loan amount	Gender 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
Gender 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.

Table 4: Least squares and quantile regression estimates

Dependent variable: log of current loan size amount

Explanatory variables	Ordinary	Quantile regression thresholds				
	least squares	10th	25 th	50th	75 th	90th
	(1)	(2)	(3)	(4)	(5)	(6)
Interest rate	-0.007 [-2.09]*	-0.000 [-0.11]	-0.002 [-0.50]	-0.011 [-2.79]**	-0.012 [-1.39]	-0.018 [-2.10]*
Client status	0.327 [4.30]**	0.308 [3.09]**	0.414 [5.17]**	0.380 [3.59]**	0.302 [2.56]*	0.200 [1.11]
Amount of previous loan	0.000 [1.15]	0.000 [1.88]+	0.000 [1.12]	0.000 [0.99]	0.000 [0.63]	0.000 [0.16]
Gender of client	-0.170 [-2.55]*	-0.018 [-0.19]	-0.141 [-1.72]+	-0.148 [-1.75]+	-0.208 [-2.30]*	-0.127 [-1.13]
Poverty score	0.538 [14.38]**	0.598 [8.54]**	0.491 [10.69]**	0.572 [12.77]**	0.499 [7.42]**	0.448 [5.50]**
Number of savings account	0.145 [1.93]+	0.016 [0.16]	0.020 [0.29]	0.035 [0.29]	0.188 [2.09]*	0.492 [3.25]**
Source of funds	0.074 [0.85]	-0.042 [-0.24]	-0.311 [-2.36]*	-0.030 [-0.33]	0.281 [2.61]**	0.571 [3.10]**
Household size	0.031 [2.11]*	-0.001 [-0.06]	0.003 [0.19]	0.029 [1.97]*	0.048 [2.38]*	0.078 [3.21]**
Location	1.643 [7.61]**	1.085 [6.86]**	1.151 [4.42]**	1.703 [4.81]**	2.178 [5.89]**	2.041 [5.19]**
Constant	13.377 [85.14]**	12.486 [61.37]**	13.222 [54.22]**	13.620 [89.73]**	13.740 [53.50]**	13.870 [48.09]**
<i>N</i>	720	720	720	720	720	720
Adj. <i>R</i> ²	0.468	-	-	-	-	-
Wald-test comparing with 50th percentile	-	F=5.53(0.02)	F=5.10(0.02)	-	F=0.00(0.95)	F=0.68(0.41)

Note: t-statistics in brackets - + p<0.10 (significant at 10%), * p<0.05 (significant at 5%), ** p<0.01 (significant at 1%).

Source: Author's compilation.

Table 5: Interaction effect and reduced samples

Explanatory variables	Interaction term (1)	Poorest sample (2)	Non-poor sample (3)	Impose restrictions (4)	Without interaction term and dummies (5)
Interest rate	-0.023 [-6.06]**	-0.044 [-4.82]**	0.011 [1.92]+	-0.012 [-2.80]**	-0.012 [-2.80]**
Client status	0.268 [3.51]**	0.462 [2.38]*	0.215 [2.53]*	0.355 [4.71]**	0.364 [4.83]**
Previous loan	0.000 [1.86]+	0.000 [0.06]	0.000 [2.23]*	0.000 [2.64]**	0.000 [2.61]**
Gender of client	-0.150 [-2.29]*	0.249 [1.36]	-0.219 [-3.01]**	-0.166 [-2.44]*	-0.151 [-2.26]*
Poverty score	-0.243 [-1.79]+	0.707 [4.22]**	0.427 [6.53]**	0.456 [7.18]**	0.499 [13.86]**
Number of savings accounts	0.142 [1.97]*	0.137 [0.86]	0.153 [2.04]*	0.146 [1.97]*	0.149 [2.01]*
Source of funds	0.349 [3.88]**	0.428 [1.70]+	0.345 [3.37]**	0.093 [1.07]	0.111 [1.32]
Household size	0.033 [2.30]*	0.106 [4.26]**	0.011 [0.64]	0.029 [1.94]+	0.029 [1.95]+
Location	0.553 [2.50]*	Dropped	0.482 [2.24]*	0.623 [2.87]**	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	1.294 [6.18]**	1.229 [5.85]**	1.192 [5.85]**
Dummy for the poorest group	-	-	-	-0.148 [-0.91]	-
Constant	13.090 [68.45]**	14.023 [29.43]**	12.813 [54.39]**	13.562 [78.94]**	13.496 [80.00]**
<i>N</i>	698	120	578	698	698
Adj. R^2	0.514	0.490	0.361	0.491	0.491
F-Statistic	67.536	31.132	27.249	54.381	58.613
Log likelihood	-818.918	-113.975	-688.867	-834.587	-835.063
Ramsey's specification test	F = 1.18 (0.316)	F = 2.41 (0.0710) +	F = 3.16 (0.0243) *	F = 7.67 (0.000) **	F = 8.38 (0.000) **
Chow-test	6.14(0.00)				

Note: t-statistics in brackets - + p<0.10 (significant at 10%), * p<0.05 (significant at 5%), ** p<0.01 (significant at 1%).

Source: Author's compilation.

Table 6: 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	-	-.018	-	.023

Source: Author's compilation.

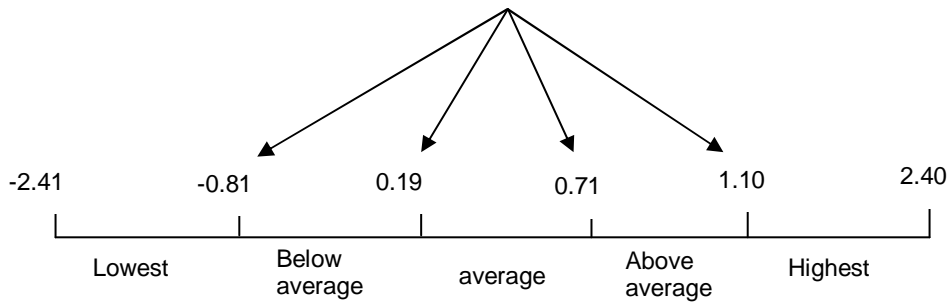
Table 7: Second stage instrumental variable and Heckman estimations

Dependent variable: amount of current loan	Coefficients and robust standard errors				
	(1)	(2)	(3)	(4a)	(4b)
Explanatory variables	Least squares	Instrumental variable	Hausman	Heckman 1.	Heckman 2.
Interest rate	-0.014 (0.004)***	-0.074 (0.010)***	- 0.060	0.016 (0.005)***	0.013 (0.005)***
Client status	0.314 (0.078)***	0.206 (0.088)**	0.009	0.044 (0.124)	- 0.014 (0.163)
Number of savings account	0.146 (0.076)**	0.205 (0.066)***	0.059	0.171 (0.59)***	0.139 (0.58)**
Amount of previous loan	0.000 (0.000)**	-0.000 (0.000)**	0.000	0.000 (0.000)***	0.000 (0.000)***
Poverty score	0.530 (0.036)***	0.499 (0.043)***	- 0.031	0.526 (0.038)***	0.537 (0.039)***
Location	1.624 (0.205)***	1.540 (0.165)***	- 0.083	1.534 (0.150)***	1.692 (0.150)***
Source of funds	0.136 (0.086)	0.555 (0.015)***	0.419	0.235 (0.105)**	0.019 (0.110)
Household size	0.029 (0.014)**	0.031 (0.024)***	0.002	0.027 (0.014)**	0.030 (0.014)**
Gender of client	-0.1880 (0.067)***	- 0.259 (0.076)***	-0.079	0.297 (0.079)***	0.268 (0.078)***
Constant	13.581 (0.170)***	15.252 (0.319)***	-	13.867 (0.202)***	14.047 (0.270)***
R-Squared	0.48	0.34	-	-	-
Number of observations				Censored - 850	Censored - 1952
	698	698		Uncensored -698	Uncensored - -698
Operational self- sufficiency [Instrument]		Correlation between Operational self-sufficiency and interest rate – [0.40]			
Hausman-test		Chi-Square 40.58 (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%

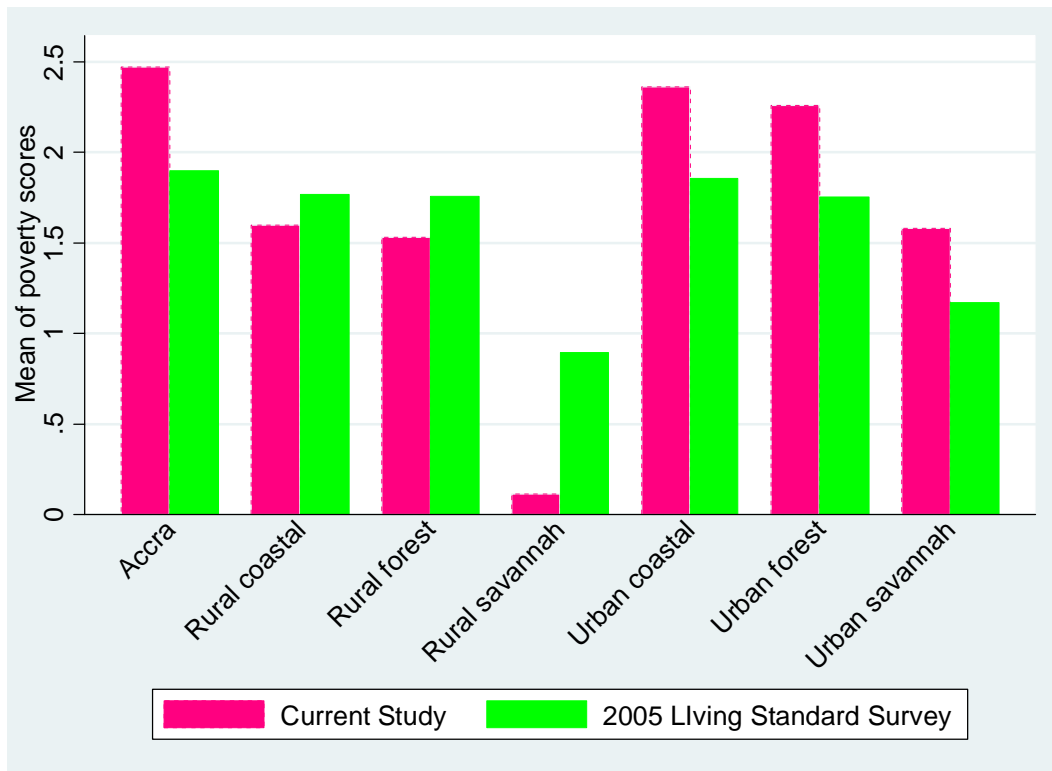
Source: Author's compilation.

Figure 1: Definition of quintiles



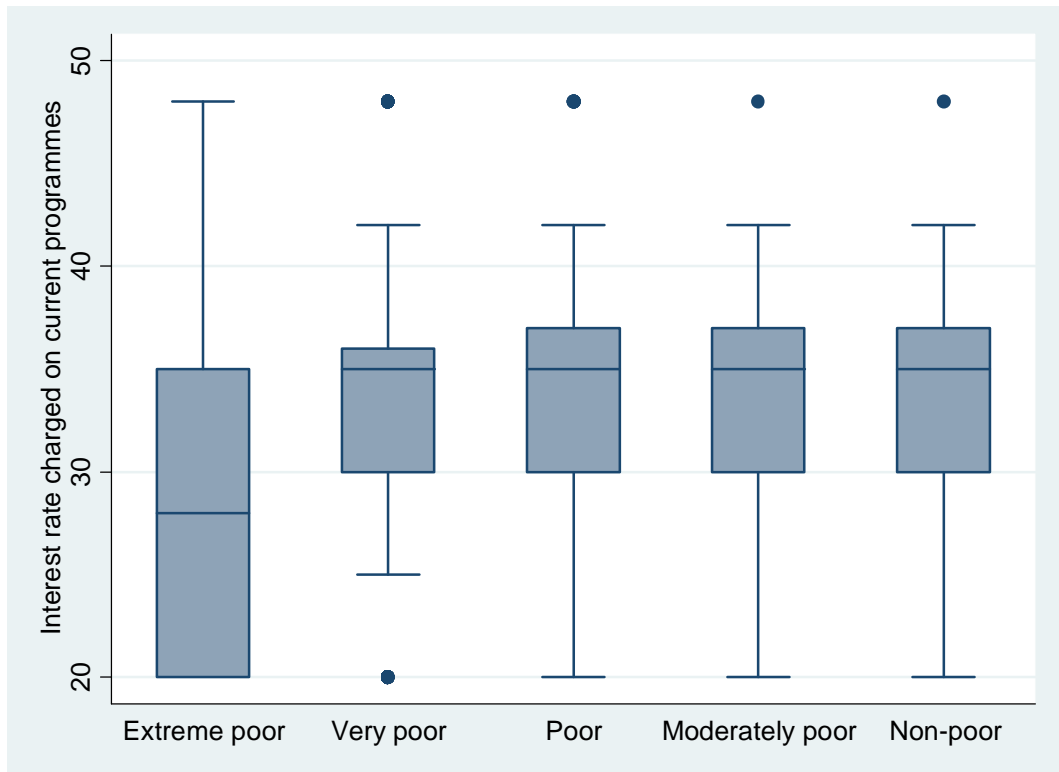
Source: Awusabo-Asare et al. (2009).

Figure 2: Data validation



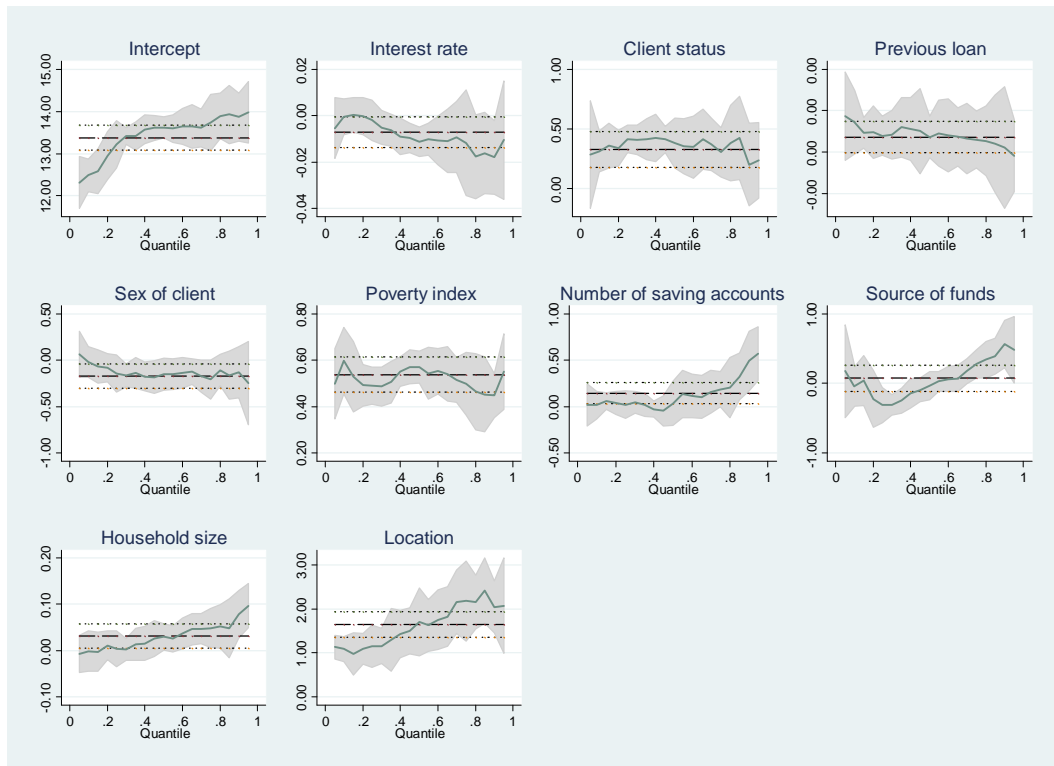
Source: Author's compilation.

Figure 3: Interest rate for different socioeconomic groups of borrowers



Source: Author's compilation.

Figure 4: Least squares and quantile regressions coefficients



Source: Author's compilation.