

Product differentiation and consumer surplus in the microfinance industry

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Abstract

Microfinance institutions (MFIs) have experienced exponential growth during the last 15 years. High repayment rates of up to 96% have drawn immense interest from both for-profit and non-profit institutions, with the number of for-profit MFIs increasing by over 800% within the last decade. Due to this rapid for-profit expansion, there has been much debate over potential crowding-out effects on non-profit MFIs. Using a Bertrand differentiated product framework, we model the price setting and demand functions of for-profit and non-profit MFIs. After empirically estimating parameters of the Nash price equilibrium, we simulate the shape and structure of the underlying demand equation. This allows us to derive and compare measures of consumers' surplus of non-profit with for-profit MFIs. Our simulations indicate that for-profit MFIs, rather than limit credit accessibility for the poor, actually fill a valuable niche. Consumers appear to benefit substantially from the presence of both types of institutions.

- *Keywords:* microfinance, credit access, non-profit, Bertrand product differentiation
- *JEL Codes:*

1 Introduction

Arising from humble beginnings, many consider microfinance loans to be the preeminent solution for the eradication of global poverty. Microfinance provides the extremely poor with access to credit and other financial services. In particular, credit access allows the poor to overcome initial capital barriers when starting businesses. It can foster economic growth, provide an avenue to escape poverty traps, and even help build social capital (Feigenberg et al. 2010). As MFIs spread into the poorest regions of the world, many see it as a means to create self-sustaining markets.

Despite the suggestion that microfinance helps fight poverty, the industry today also faces a strong backlash from previously staunch proponents. The introduction of for-profit MFIs has led to charges by early microfinance entrants that for-profit MFIs are “loan sharks.”¹ One such for-profit institution, *Banco Compartamos*,² has recently taken an aggressive action by launching its initial public offering. Since going public, *Compartamos* has often charged annual interest rates on some individual loans that exceed 100%, which some view as usury.³

This apparent divide between for-profit and non-profit MFIs has spurred policymakers and researchers to debate how best to alleviate global poverty. Important to this debate is a need to understand how MFIs compete with each other. Do institutional differences over profit lead to real, measurable differences in the microfinance market? What role or market niche do these institutions serve, and do consumers receive any measurable surplus from either type of firm? Given that the current economic literature has not theoretically approached the impact of interactions between for-profit and non-profit MFIs, we specify a Bertrand differentiated product model to analyze MFI competition and measure the corresponding implications on consumers’ surplus. Our empirical results indicate that growth during the past decade of for-profit MFIs has coincided with expansions in consumer surplus per loan provided in the microfinance market. In addition to this, consumer surplus per loan and the total consumer surplus provided by the average for-profit firm exceeds that of non-profit MFIs. While our research cannot directly ad-

¹Retrieved from *The Times of India*, February 21, 2011. “Profit-focused MFIs are loan sharks”, Muhammad Yunus.

²*Banco Compartmantos* began as a NGO in 1990 but had its Initial Public Offering in 2007.

³Average interest rates are lower.

dress the counter-factual of a world without for-profit MFIs, at the very least our results indicate that the for-profit sector may not be the market-killing bugaboo that critics assert. Rather, it appears to serve an important role in the provision of financial services to the poor and provides the potential to expand economic growth.

1.1 Motivation & Stylized Facts

Microfinance provides credit access to many individuals typically deemed too risky for loans from traditional banks. Innovations such as peer and group lending allow MFIs to overcome issues of moral hazard inherent with traditional non-collateralized loans and appear to offer efficiency gains in contracting.⁴ As a consequence of high repayment rates, MFIs continue to rapidly expand on a global scale. Microfinance has indeed expanded in almost every nation. The prominent rise of microfinancing over the last decade has drawn significant attention to a loan industry once thought infeasible due to the perceived high risk of default. Consequently, markets once primarily comprised of non-profit MFIs now face competition from for-profit banking institutions.

Data⁵ obtained from the publically available microfinance information exchange provides insight into the current clash between for-profit and non-profit MFIs. For-profit MFIs appear to have higher average loan balances per borrower than their non-profit counterparts as indicated in figure 1. After 2002, however, the differences in loan balances for the two types of firms are not statistically significant at the 95% level⁶. This lack of a statistical difference in loans size raises questions regarding why interest rates between the two MFI-types differ. In recent years, for-profit MFIs have held more assets and consequently had larger gross loan portfolios.⁷ The large size of for-profit institutions has generated fears that as more for-profit institutions enter the microfinance industry, they will crowd-out non-profit institutions, which could further reduce borrower access to financial services.

⁴Stiglitz (1990), Banerjee et al. (1994), Besley and Coate (1995) and Ghatak (1999, 2000) suggest that group lending helps reveal credit worthiness and allows banks to offer loan contracts that more closely reflect the credit ratings of the borrowers (e.g. a low risk borrower will be offered a lower interest rate).

⁵The data consists of 91.3 million borrowers from 1900 MFIs and is aggregated on the firm level ranging from 1995 to 2009.

⁶The lower half of figure 1 shows the differences in mean values with a 95% confidence interval.

⁷The gross loan portfolio is the total dollar amount of all loans provided by an MFI.

Differences in interest rates could arise, at least in theory, from differing cost structures between the for-profit and non-profit MFIs. If for-profit institutions have higher lending costs, then we have a partial explanation for higher interest rates. Lower marginal costs of loans in the non-profit sector could occur if banks use group contract incentives as opposed to individualized loans offered by for-profit MFIs. In a sense, the individuals in a group serve as monitors of themselves and ensure repayment, thereby leading to less effort from the banking institution to ensure repayment. If true, then for-profit banks which rely more on individuals loans would bear the cost of monitoring, and would transfer this to consumers in the form of higher interest rates. Since we do not observe large differences in the average variable cost of microfinance loans between the two sectors, we have to ask what else drives differences in interest rates and ultimately in demand.

With group lending, monitoring costs are shifted onto groups of customers rather than burdened by the bank. This implicitly increases the incidence of transaction costs for borrowers and may appear as a downward shift in the demand curve for non-profit loans relative to for-profit loans. For example, long travel times to get to group meetings represent an unseen (to the researcher) transaction cost borne by borrowers.⁸ If these group meetings exist primarily among those with non-profit loans, interest rate differences may arise across all loan amounts in the non-profit sector. That is, non-profit consumers may internalize the actual cost of loans as the sum of the interest rate plus all transaction costs.

Throughout the last decade, for-profits have tended to charge higher interest rates at various times. This begets the question, how do MFIs set interest rates? In the case of a homogeneous and perfectly competitive market, we would expect to observe a single equilibrium price. At first glance, it would appear logical to presume that all MFIs produce a homogeneous loan. This single price equilibrium, however, does not exist. Firms within the same market appear *ceteris paribus* to charge different interest rates. This difference leads us to postulate that MFIs produce differentiated products. This product differentiation may take various forms: different term-structures or maturities on the loans, group lending stipulations versus individual lending, and other criteria such as the weekly meetings mentioned above. MFIs and hence MFI loans are

⁸Some Chinese clients take over an hour to walk to group meetings (Armedriz and Morduch 2000).

therefore understood to have different attributes. We believe these attribute differences serve as a primary driver of the interest rate and equilibria differences observed in microfinance markets.

1.2 Literature Review

Non-collateralized lending research to date involves studies that model group lending versus individual lending such as Ghatak (1999), and interactions between the bank and borrower under asymmetric information conditions (Chan and Thakor, 1987). Chan and Thakor (1987) find that high-quality borrowers may have to put up higher collateral when private information is unknown. Using a risk-based pricing model, Edelberg (2003) studies US non-collateralized consumer loans and suggests that demand for non-collateralized loans decreases when risk based pricing is used. Edelberg (2003) also suggests that very little is known about the determination of interest rates on non-collateralized consumer loans.

Empirical studies of MFIs have begun to analyze stylized details of loan demand within the industry. For instance, the demographic reach of MFIs is studied in Cull, Demiguc-Kunt, and Morduch (2008). Of particular interest, they find that non-profits serve more women borrowers and use more subsidies. Female borrowers are generally seen as lower risk than male borrowers. Studies such as the one conducted by Khander and Pitt (1998) support this and find that women use borrowed funds more efficiently than male borrowers, at least in terms of social yardsticks.⁹

On the other hand, rather than explore gender effects, Dehejia et al. (2005) look at wealth and find that less wealthy borrowers appear highly sensitive to interest rates. Their research also suggests that as interest rates rise, the MFIs customer base shifts to the wealthier at the expense of outreach to the poorest.¹⁰

Perry (2002) provides indirect evidence indicating that clients who did not receive an MFI loan often turn to predatory moneylenders. Most often, off-market moneylenders charge even higher interest rates and indeed the ramifications of non-payment may be more severe. If true, then for-profit MFIs can extend loans to clients unable to gain access to traditional non-profit loan market. They can fill a gap in the market traditionally occupied by more dangerous and

⁹e.g. the likelihood of children getting an education, household expenditure or housing.

¹⁰We note that if for-profit MFIs charge higher interest rates, their customer base may differ from that of a socially driven MFI. This suggests the possibility of a socially beneficial coexistence.

expensive money lenders.

2 Theory

We model the microfinance industry using a Bertrand model with differentiated products. Using a differentiated product model modifies the assumption of identical goods and assigns attributes to goods. Prices are set simultaneously, and firms do not cooperate. The two distinctly different firms in the model are represented by for-profit and non-profit firms. Traditionally, a Bertrand differentiated duopoly is treated as a pure price setting equilibrium in a horizontally differentiated market. Bester (1992) uses a demand function that relies on a discrete choice model of consumer preference. We are unable to use discrete choice models since consumers can borrow from different firms at different prices and quantities (i.e. different products). Hence, we assume that borrowers have a continuous set of loan alternatives and a continuous set of loan sizes.¹¹ For tractability, we also assume that firms face constant marginal costs.

The products produced by MFIs are loans with attributes used to differentiate the product. As a simplification, MFI attributes are modeled as endowments and *not* as choices. Attribute differences generate a preference for one firm's product over another. This translates to the price that consumers will pay for the product.¹² Since attributes are often unobservable, we use proxies to measure the aspects of loans that may affect borrower choices. For instance, a consumer may prefer less monitoring rather than more, a choice not easy to quantify.

We use two proxies to measure unobserved attributes: *for-profit* status and *women-to-borrower ratio*.¹³ For-profit MFIs generally engage with borrowers on an individual level rather than as a group. Part of the impact of this is fewer meetings (less monitoring) and lower transaction costs for borrowers. Therefore, *for-profit* status may enable us to capture the preference of consumers for reduced monitoring by the MFIs. Product image, another unobservable preference, is captured by the *women-to-borrower ratio*. Firms that loan more to women tend to gear services

¹¹McIntosh et al. (2005) find in Uganda that increased competition results in multiple loan-taking by borrowers. This further substantiates the need for a continuous choice framework.

¹²Any reference to product or firm is synonymous as we presume that each firm produces a single product. The product differentiation exists not within the firm but between firms.

¹³The *women-to-borrower ratio* refers to the proportion of female borrowers for a firm's loans.

more towards poverty alleviation, or are at least project the image of doing so.¹⁴ In turn, borrowers may be attracted to those firms perceived as helpers of the poor, rather than pure profit extractors.¹⁵ The *women-to-borrower ratio* reflects these overarching goals of non-profit MFIs. Since women appear to use borrowed funds more efficiently for social goods (Khander and Pitt, 1998), it may serve to capture consumer preferences for more “socially just” loans.

Cull, Demiguc-Kunt, and Morduch (2008) note that over the past two decades, for-profit and non-profit firms alike were encouraged to achieve financial sustainability by earning ample profits. This suggests that both for-profit and non-profit have profit maximization objective functions.¹⁶ Additionally, a lack of consensus on the objective function of non-profit organization results in a profit maximization model for non-profit organizations being an appropriate model (Danzon, 1982). Current literature (Dehejia et al. 2005) also suggests that microfinance customers have a high elasticity of demand as they were unwilling to pay high prices. For these factors, we deduce that the objective function of non-profit MFIs is similar to for-profit MFIs.¹⁷ This leads us to also assume that both types of firms exhibit a profit maximization objective function. The profit function for the i th MFI is given as

$$\pi_i = (p_i - c_i) q_i(p_i, p_j, a_i, a_j, b_i, b_j) , \quad (1)$$

where p_i and p_j represent the own-price and competitor price of loans (interest rates).¹⁸ We allow for two types of attributes for firms i and j and represent these with a and b ¹⁹. Market demand for firm i 's loans appear as $q_i(\cdot)$, while c_i represents marginal cost. Firms have perfect information concerning the prices and costs of other firms in the market.

Assume a linear demand function and also assume that consumers have complete information

¹⁴Mutalima 2007; Mayoux and Hartl 2009; Kandkar 2005 and Hashemi et al. 1996

¹⁵The warm glow effect suggests a consumer preference to altruistic behavior. For instance, consumers are willing to pay a price premium to shop at Whole Foods because of the clean and green image they offer (Baron 2007).

¹⁶Holtmann (1983) has shown that in the hospital industry profit maximizing prices would approach non-profit [welfare] maximizing prices when the elasticity of demand is large.

¹⁷The key distinction between the two types of firms is simply that for-profit institutions pay out a portion of their returns to their shareholders while non-profits do not.

¹⁸Firm i and j are representative firms that can take on any characteristic and are in competition.

¹⁹Our attributes ultimately include *for-profit* indicator variable and the *women-to-borrower ratio*.

and freedom of choice between firms i and j .²⁰ This results in a specification of demand as

$$q_i = \tau + \phi a_i + \psi a_j + \omega b_i + \zeta b_j + \eta p_i + \mu p_j, \quad (2)$$

where q_i represents the dollar amount of loans demanded from firm i . With two MFIs, a *for-profit* and a *non-profit*, we attempt to sign the parameters of firm i 's demand. Prior expectations obviously assume that $\eta < 0$, and the gross substitutability of loans implies a positive cross-price effect, $\mu > 0$.

For-profit MFIs have higher loan balances per borrower than non-profits, so we expect that for-profit MFIs have greater demand for their loans than those from non-profit MFIs, *ceteris paribus*. The internalization of transaction costs by borrowers previously mentioned serves as one possible reason. For-profit firms may have less monitoring, and if consumers favor these more relaxed lending requirements, we would anticipate greater demand. If a_i is defined as a for-profit dummy with 1 representing an MFI registered as for-profit, then $\phi > 0$. If consumers have some other unobserved, non-pecuniary preference for non-profit loans, (e.g. trustworthiness, social justice issues, etc.) then $\phi < 0$.

Since the model consists of two firms, a_j represents the profit status of the competing firm. As a_j captures the unobservable attribute of ease of borrowing from firm j , we expect that fewer transaction costs (e.g. less monitoring) for firm j loans would decrease demand for firm i loans. Since for-profit status could serve as this proxy for the ease of credit, the presence of a for-profit competitor would negatively affect demand of firm i . This leads to the expectation that $\psi < 0$. If $\psi > 0$, however, demand for i 's loans increases with the presence of a for-profit competitor.

Reports indicate that non-profit MFIs lend to more women due to their stronger sense of financial responsibility and lower default rates (Khander & Pitt, 1998). The variable for *women – to – borrower ratio* serves as a proxy for the unobservable consumer preference for a “socially just” product. Firms that have more female borrowers may be perceived by other potential borrowers as more socially orientated and perhaps even more scrupulous. As such, firms with a more female-orientated customer base may have increased demand for loans. This suggests that

²⁰In latter estimates of the model, firm j is defined as the aggregate average of all of the other MFIs within the country where firm i is located.

ω is positive and ζ is negative.

2.1 Best Responses and the Nash Equilibrium

Combining (2) and (1) generates the first-order condition for profit maximization and the best response function for firm i :

$$p_i = \frac{c_i}{2} - \frac{1}{2\eta} [\tau + \phi a_i + \psi a_j + \omega b_i + \zeta b_j + \mu p_j] . \quad (3)$$

An analogous best response function exists for firm j . Solving both functions simultaneously for the p_i yields the Nash price equilibrium in the market for firm i loans:

$$p_i^* = \frac{[\mu-2\eta]\tau}{4\eta^2-\mu^2} + \frac{2\eta^2}{4\eta^2-\mu^2} c_i - \frac{\eta\mu}{4\eta^2-\mu^2} c_j + \frac{\mu\psi-2\eta\phi}{4\eta^2-\mu^2} a_i + \frac{\mu\phi-2\eta\psi}{4\eta^2-\mu^2} a_j + \frac{\mu\zeta-2\eta\omega}{4\eta^2-\mu^2} b_i + \frac{\mu\omega-2\eta\zeta}{4\eta^2-\mu^2} b_j . \quad (4)$$

A similar equilibrium price can be derived for firm j . A graphical representation of the best response functions and Nash equilibrium is shown in figure 2. This also shows how a decrease in preferences for firm j loans results in a shift in the best response function of firm j to j' . This would correspondingly generate a new equilibrium where both firms charge a lower price. The theoretical framework highlights the importance of accounting for strategic interactions between the firms in the market. Shocks to either function have consequences on both firms' prices.

The true parameters of the demand for firm i loans are given by (4), but notice the linear structure that allows us to solve the simple model via methods of linear regression. That is, we can redefine the complicated function of parameters from (4) and specify the regression:

$$p_i^* = \beta_0 + \beta_1 c_i + \beta_2 c_j + \beta_3 a_i + \beta_4 a_j + \beta_5 b_i + \beta_6 b_j + \epsilon , \quad (5)$$

where ϵ represents an unobserved regression error with conditional mean equal to zero. Note how (5) also cannot actually recover the parameters of the structural demand equation (2), since the reduced form parameters $(\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6)$ produce non-unique values for $(\tau, \eta, \mu, \phi, \psi, \omega, \zeta)$. Since we cannot recover the true structural parameters of demand, we will attempt to simulate

these based-on an assumption regarding μ , the cross-price effect.²¹

Equation (5) is estimated using a panel dataset of various MFIs from the years 2003-2009. For this paper, the product and firm are synonymous, (i.e. firm i produces one type of product, i , which is differentiated by the consumers' preferences over attributes a and b). Furthermore, in our two-firm model of i and j , the j firms are defined as the average of all of the other firms within a country. This inherently assumes that firms face competition only from other firms within the same country. It also assumes that capital mobility is limited within a country and, hence, borrowers choose loans only between firms within the same country.

3 Data

The Microfinance Information Exchange (MIX) is a non-profit organization that helps to collect and validate data in all regions of the developing world. The data is freely available online at the MIX market website. We incorporate the for-profit status of MFIs using another MIX publication, the *Microbanking Bulletin*, an annual publication.

Yield on gross loan portfolio is chosen as a proxy for price. It is the most tractable and easily available piece of price data for how MFIs value loans to borrowers. In particular, the yield on gross loan portfolio is the nominal interest and fees on the gross loan portfolio. To estimate the model over entire markets, the variables representative of j firm attributes and costs are represented by averages of all firms (not i) in i 's market. Since a period in the data set is defined as one year, MFIs likely respond to changes by their competitors within days rather than over a year. Given this, we assume that effects from changes in competitors' attributes and prices generate responses within the same time period. The attribute proxies, the *for-profit* dummy and the *women-to-borrower ratio*, are used in all specifications. The *for-profit* binary variable assigns a value of one to for-profit firms and zero to non-profit firms. Because the j *for-profit* variable is an average of the firms other than i within the country, it reflects the composition of the other MFIs within i 's country.

We assume that firms have constant marginal cost. A very close proxy in our data is labor

²¹We discuss this assumption in a later section.

cost per dollar loaned. This subsequently assumes that marginal and average variable costs are the same. All else equal, we expect that higher marginal costs logically result in firms charging higher prices in imperfectly competitive markets. Note for the Nash equilibrium in (4) to make sense, we also need $4\eta^2 > \mu^2 \implies 2|\eta| > \mu$. Without this, an increase in a firm's marginal cost would drive down its equilibrium price. Therefore, a necessary condition for our empirical model to consistently link to the theory is for $\beta_1 > \beta_2$.²²

Data is organized and identified uniquely by the MFI identification number (MFIID), year, country and continent. The analysis focuses on 3156 MFI observations over the years from 2003 to 2009, and reflect data on 895 different microfinance institutions. We use a pooled OLS regression to estimate the reduced form of the Nash price equation shown in (5). Additionally, we include results from a pooled OLS with continent dummies, and random effects panel regressions. We limit the analysis to firms with an average loan balance per borrower of less than \$5000. Within this group, 2280 MFIs control loans with average loan balances less than \$1000.

²²A little algebra can show from the reduced form parameters that

$$\eta = -\frac{\mu \beta_1}{2 \beta_2} .$$

The only way $2|\eta| > \mu$, is if $\beta_1 > \beta_2$, and if β_1 and β_2 share the same sign. Without this, empirical estimates would not be consistent with the theoretical model.

Table 1: Descriptive Statistics

variable	<i>for-profit</i>	<i>non-profit</i>	<i>combined</i>			
	mean	mean	mean	std. dev.	min	max
interest rate (%), firm <i>i</i>	34.96	33.45	33.89	16.16	0	100
interest rate (%), firm <i>j</i> average	36.18	32.57	33.62	12.30	5	100
marginal cost, firm <i>i</i>	0.246	0.242	0.244	0.172	0.002	0.995
marginal cost, firm <i>j</i> average	0.263	0.233	0.242	0.121	0	0.924
for profit dummy, firm <i>i</i>	1	0	0.292	0.455	0	1
for profit dummy, firm <i>j</i> average	0.435	0.230	0.290	0.273	0	1
women/borrowers, firm <i>i</i>	60.54	67.77	65.66	25.76	0	100
women/borrowers, firm <i>j</i> average	65.92	65.10	65.34	18.42	0	100
average loan balance (\$)	824.43	806.95	812.04	905.79	13	4996
gross loan portfolio (\$)	4.39e-7	2.05e-7	2.73e-7	1.02e-8	10469	3.02e-9
Africa	0.203	0.168	0.178	0.383	0	1
Asia	0.447	0.308	0.349	0.477	0	1
Europe	0.034	0.080	0.098	0.271	0	1
North America	0.148	0.163	0.159	0.365	0	1
South America	0.156	0.236	0.213	0.409	0	1
observations	920	2236	3156			

Firm *j* averages based on firm *i*'s country but not including firm *i*'s value.

Since marginal cost is represented by a firm's average labor cost per dollar loaned, we eliminate outliers with reported marginal cost equal to zero (1 observation) or a marginal cost that exceeds 1 (68 observations). Also eliminated are 13 additional observations with interest rates greater than 100%. This leaves us with 3156 observations from 895 different MFIs over the 7 year period. Table 1 provides summary statistics for the sample. The average interest rate charged across all MFIs is 34%. Note that 29% of the sampled observations indicate status as a *for-profit* MFI. Note also that *for-profit* firms tend to congregate in countries with more *for-profit* competitors, as indicated by the within-group average for the variable "for profit dummy, firm *j*". The average for women borrowers is *not* a measure weighted by the size of firms. For-profit firms also appear to give slightly larger loans, as witness by the average loan balance. This should be considered lightly, however, since this does not measure the value of the originated loans, but rather only what remains on balance.

4 Results

Table 2 reports estimates from four specifications based on equation (5). Column (1) represents the simplest OLS specification. Column (2) includes random effects to the basic model to account for within firm unobserved heterogeneity across the panel. Column (3) presents OLS estimates with continent fixed effects and column (4) includes random effects estimates with continent fixed effects. All tables throughout the rest of the paper follow from these basic empirical specifications.

We start by focusing on the first column from a pooled ordinary least squares (OLS) regression on interest rates. The positive coefficient of the marginal cost of firm i suggests that a \$.01 increase in labor costs per dollar loaned increases interest rates by a little more than one-half a percentage point. This relationship falls in line with the expectation of a positive relationship between price and marginal cost. Furthermore, as the marginal cost of other firms in the market increase by \$.01, interest rates charged by firm i rise by slightly more than a quarter of a percentage point. This is also not surprising when one reconsiders the comparative statics demonstrated in figure 3. Due to the symmetry expressed by the best response functions, we expect that when one firm's marginal costs increase, equilibrium interest rates rise across all firms in the same market. *Ceteris paribus* price changes in response to changes in competitor costs imply some degree of pricing power as well.

Although firm i 's *for-profit* dummy is not significant at 10% in specification (1), robustness checks from specifications given in columns (2), (3) & (4) verify the positive relationship of this explanatory variable on interest rates. In the preferred empirical results presented in column (4), holding everything else equal regarding Nash equilibrium lending, for-profit institutions charge a little more than two percentage points more in interest than non-profit institutions. In addition to this, as a market becomes more saturated with for-profit institutions, interest rates rise. A ten percentage point increase in the for-profit saturation of a market drives-up equilibrium interest rates by two to three-tenths of a percentage point.

Table 2: Interest Rate Effects

Variable	(1) OLS	(2) FGLS	(3) OLS	(4) FGLS
Marginal cost, firm i	54.78*** (2.390)	41.72*** (2.817)	54.64*** (2.349)	41.09*** (2.777)
Marginal cost, j firms	25.96*** (2.428)	16.73*** (2.442)	24.83*** (2.364)	15.422*** (2.483)
For-profit, firm i	0.773 (0.480)	2.005** (0.881)	1.050** (0.474)	2.258*** (0.874)
For-profit, j firms	2.703*** (0.830)	2.068* (1.196)	3.917*** (0.865)	2.235* (1.218)
Women/borrowers, firm i	0.108*** (0.011)	0.102*** (0.012)	0.110*** (0.010)	0.100*** (0.011)
Women/borrowers, j firms	-0.066*** (0.014)	-0.041*** (0.016)	-0.061*** (0.016)	-0.041** (0.017)
Africa	-	-	-1.796*** (0.659)	0.615 (1.193)
Europe	-	-	3.144*** (0.757)	1.138 (1.301)
North America	-	-	4.917*** (0.658)	7.852*** (1.255)
South America	-	-	1.838*** (0.545)	1.825* (0.936)
Constant	10.51*** (0.849)	14.136*** (1.653)	8.797*** (1.185)	12.80*** (1.479)
R-squared	0.562	0.557(overall) 0.609(between) 0.147(within)	0.579	0.563(overall) 0.615(between) 0.148(within)
Breusch-Pagan χ^2	-	1601***	-	1518***
Observations	3156	3156	3156	3156
Groups		895		895

Notes: Robust standard errors in parentheses.

*significant at 10% **significant at 5% ***significant at 1%

FGLS estimations include institution-specific random effects

“Asia” serves as the reference group for estimates with continent effects

We can also explore interest rates for firms with more female borrowers. Regardless of the specification, results indicate that a one percentage point increase in the women-to-borrower ratio increases the interest rate by one-tenth of a percentage point. Further evidence can be found from firm j 's *women-to-borrower ratio*, which indicates a decline of 0.06% points in firm i 's interest rate. When an attribute or cost shifts the best response function for a single firm, the

Nash equilibrium price shifts in sensible directions for all firms competing in the same market. The overall fit of these models appears strong with 56% of the variance in interest rates explained. We also include alternative estimates in table A2 of the appendix that include fixed effects for each year. Empirical results are robust to these alternative specifications.

4.1 Simulation of Market Demand

Using estimates reflected in column (1) of table 2, we attempt to recover the original parameters of demand from equation (2). Identification is a problem, however, since non-unique solutions exist for the parameters $(\tau, \eta, \mu, \phi, \psi, \omega, \zeta)$ when derived from estimates for $(\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6)$. For this simulation, we assume a value for μ , the cross-price effect, and use the results from the empirical estimations to simulate parameters of the demand for MFI loans. These drop out of the linear model as combinations of the assumed estimate of the cross-price effect, $\tilde{\mu}$, and the corresponding estimate for the own-price effect, $\tilde{\eta}$. Solving out for the denominators of the structural parameters generates the estimated own-price effect on demand as

$$\tilde{\eta} = \frac{-\tilde{\mu} \hat{\beta}_1}{2 \hat{\beta}_2} .$$

Using the estimated parameters $(\hat{\beta}_0, \hat{\beta}_1, \hat{\beta}_2, \hat{\beta}_3, \hat{\beta}_4, \hat{\beta}_5, \hat{\beta}_6)$, a little algebra can also show the following:

$$\tilde{\phi} = \tilde{\mu} \left(\frac{\hat{\beta}_1 \hat{\beta}_3}{\hat{\beta}_2} - \hat{\beta}_4 \right) ,$$

$$\tilde{\psi} = \tilde{\mu} \left(\frac{\hat{\beta}_1 \hat{\beta}_4}{\hat{\beta}_2} - \hat{\beta}_3 \right) ,$$

$$\tilde{\omega} = \tilde{\mu} \left(\frac{\hat{\beta}_1 \hat{\beta}_5}{\hat{\beta}_2} - \hat{\beta}_6 \right) ,$$

$$\tilde{\zeta} = \tilde{\mu} \left(\frac{\hat{\beta}_1 \hat{\beta}_6}{\hat{\beta}_2} - \hat{\beta}_5 \right) ,$$

$$\tilde{\tau} = \tilde{\mu} \left(\frac{\hat{\beta}_0 (\hat{\beta}_1 - \hat{\beta}_2)}{\hat{\beta}_2} \right) .$$

Importantly these highlight how the structural parameters of demand are functions of the reduced form parameters of the Nash equilibrium, scaled monotonically by the cross-price slope, μ . We use this simple result to simulate alternative ranges for the demand equations as well

as consumer surplus. For future discussion, this result also implies that relative comparisons across groups (e.g. percentage differences between for-profit and not-profit institutions) remain constant regardless of the cross-price elasticity. In a sense, since a principal goal is to compare consumers' surplus of loans from for-profit with non-profit MFIs, the value of μ only affects the scale rather than the *percentage* differences or even the sign.

That being said, we still prefer to work with a plausible value for μ to set up our discussion. Following from Hollo's (2010) analysis of banking markets in a developing country, we set the cross-price elasticity on non-collateralized consumer lending at 0.25. Using this and mean values from the data, we compute our estimate of μ to be $\tilde{\mu} = 5.547$.²³ Using this, we simulate the demand for the dollar value of loans for each firm. The results of these simulations based on each alternative empirical specification appear in table 3.²⁴ First and most importantly, the own-price effect on demand is negative in simulations derived from all empirical specifications.

Secondly, demand for loans from for-profit institutions appears less than the demand for non-profits. This result however reverses sign as more for-profit institutions enter a market. Not surprisingly, increasing the saturation of for-profit firms in a market leads more customers to move towards the *ith* firm. And finally, firms with higher women-to-borrower ratios also have higher demand. As firm *i*'s competitors increase loans to women (possibly through group lending approaches), demand for firm *i* loans decreases.

Delving further into the results of column (1), if the firm itself is for-profit, its demand is \$6 less per loan. A value of 1 for a_j reflects the fact that all competing firms in the country are for-profit, so a one-percentage point increase in the for-profit saturation of a market increases demand for the *ith* firm's loans by \$0.27 per loan. The results for columns (2) and (4) which control for unobserved heterogeneity, however, overturn the results for ζ . From these preferred empirical specifications,²⁵ it appears that the *ceteris paribus* demand of for-profit loans is approximate \$16 to \$20 more per loan. These alternative specifications also indicate that demand increases by

²³See Appendix for derivation

²⁴Columns in tables 3,4 and 5 that are labeled with "(1)" represent simulations based on the OLS regression reported in column (1) of table 2. Columns labeled with "(2)" represent simulations based on the random effects regression reported in column (2) of table 2. This analogy exists for columns (3) and (4) of table 2 as well.

²⁵These are "preferred" based on lagrange multiplier tests.

\$0.17 – \$0.22 for every percentage point increase in a market’s for-profit saturation. This result may simply reflect the fact that non-profit MFIs in our sample tend to operate in markets with fewer for-profit competitors.²⁶

The simulated coefficients on the the effect of the *women-to-borrower ratio* support our *a-priori* expectations. If firm *i* increases the women-to-borrower ratio by 1%, the results in column (1) suggest that the demand for loans increases by \$1.63. In contrast to this, as the market becomes more saturated with firms catering to women borrowers, demand for the *i*th firm’s loans drops by 1.37. These results are very robust across various empirical specifications.

Table 3: Simulated Parameters of Demand

parameter	(1)	(2)	(3)	(4)	(1)	(4)	(1)	(4)
	$\mu = 5.547$	$\mu = 5.547$	$\mu = 5.547$	$\mu = 5.547$	$\mu = 1$	$\mu = 1$	$\mu = 10$	$\mu = 10$
$\eta...$ (own-price slope)	-5.85	-6.91	-6.10	-7.39	-1.06	-1.33	-10.55	-13.32
$\phi...$ (for-profit, i)	-5.94	16.25	-8.91	20.36	-1.07	3.67	-10.71	36.70
$\psi...$ (for-profit, j)	27.36	17.48	41.98	22.14	4.93	3.99	49.32	39.91
$\omega...$ (women, i)	1.63	1.64	1.68	1.71	0.29	0.308	2.94	3.08
$\zeta...$ (women, j)	-1.37	-1.14	-1.35	-1.16	-0.25	-0.21	-2.47	-2.08
$\tau...$ (constant)	64.67	117.07	-	-	11.67	-	116.71	-
τ_{Africa}	-	-	46.60	123.82	-	22.32	-	223.21
τ_{Asia}	-	-	58.55	118.14	-	21.30	-	212.98
τ_{Europe}	-	-	79.48	128.64	-	23.19	-	231.92
$\tau_{NorthAmerica}$	-	-	91.29	190.64	-	34.37	-	343.68
$\tau_{SouthAmerica}$	-	-	70.79	134.99	-	23.37	-	243.36

Random effect estimates assume $E(c_k) = 0$, where c_k is the unobserved effect for the k^{th} observation.

5 Simulated Consumer Surplus

Table 4 includes estimates of consumer surplus per loan, calculated from parameters of demand presented in table 3 and using the assumption that $\mu = 5.547$. Since our measure for marginal cost is based on each dollar loaned by an institution, we assume that the demand function for each firm we construct follows commensurately as the willingness-to-pay per dollar loaned from each different MFI. As stated earlier, these simulations follow from the empirical results

²⁶See descriptive statistics for the variable “for-profit dummy, firm j average” shown in table (1).

presented in table 2, with specifications linked across different tables by the column numbers in parentheses. Table 4 shows the average consumer surplus of for-profit firm loans compared with those of non-profit firm loans from 2003-2009. Over this period, the average balance of loans held by for-profit firms is \$824, while the average balance held by non-profit firms is \$807.

These results indicate that for-profit MFIs consistently exhibit greater consumer surplus per loan than the non-profit MFIs. Most conservatively, it appears that for-profit institutions provide at least as much consumers' surplus per loan as non-profit institutions (as supported by the results from column (3)). If we take the random effects coefficient estimates in the most broadly specified model with continental effects (model (4)), then for-profit institutions provide as much as 25% more consumer surplus per dollar loaned than non-profit firms. These firms clearly fill an important market niche.

Table 4: Average consumer's surplus per loan, (\$)

year	for-profit MFIs				non-profit MFIs				% difference			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
2003	1124	1842	1131	1976	850	1122	845	1102	32.2	64.2	33.9	79.3
2004	1299	2009	1339	2168	1034	1325	1112	1515	25.7	51.7	20.5	43.0
2005	874	1579	897	1737	986	1346	1040	1483	-11.3	17.3	-13.8	17.1
2006	946	1627	920	1774	905	1308	941	1437	4.6	24.4	-2.2	23.4
2007	1080	1785	1061	1901	931	1350	965	1481	16.1	32.2	10.0	28.3
2008	954	1671	923	1741	965	1349	1000	1477	-1.2	23.9	-7.7	17.8
2009	968	1710	961	1800	935	1346	977	1493	3.6	27.0	-1.8	20.5
overall	1000	1712	989	1825	945	1332	986	1465	5.6	28.5	0.3	24.6

Columns based on specifications from table 2 and assume $\mu = 5.547$.

Finally we attempt to measure the overall consumer outreach of a typical MFI with results shown in table 5. That is, if part of the goal of microfinance loans is to expand credit market access to the poor, then a measure of the total consumer surplus produced by a firm provides one snapshot into the relative impact of an MFI's loan on its consumers. To calculate these estimates of aggregate consumer surplus, we multiply the per loan average consumer's surplus at a firm by the number of loans held by the firm.²⁷

²⁷We assume that each firm only supplies one loan to each customer. Hence, the number of customers equals the number of loans.

If we work with the most conservative empirical estimates, then the average for-profit firm generates slightly more than \$70 million in consumer surplus, while non-profit firms average a little more than \$26 million apiece. Since the average gross loan portfolio is approximately \$27 million, these estimates do not seem unreasonable. If we use the more empirically solid estimates highlighted in column (4), these outreach measures jump to \$169 and \$95 million.

These results do not comment on either the presence or absence of usury. A single firm may still charge an exorbitant interest rate on a specific loan. They do indicate, however, that for-profit institutions fill a substantial niche in the microfinance market. Consumer surplus appears to not only be large, but over time and more importantly, it has grown for *both* non-profit and for-profit firms alike. For both, market outreach (measured in terms of total consumers' surplus) has more than doubled since 2003. To simply wipe-away either sector could have devastating impacts on the consumers served by both types of firms.

Table 5: Total consumers' surplus per firm, (\$ million)

year	for-profit MFI average				non-profit MFI average				% difference			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
2003	42	80	43	86	27	47	24	42	56.4	70.1	76.4	105
2004	68	123	66	128	92	127	96	135	-28.8	-2.8	-29.2	-5.2
2005	73	179	65	178	44	76	42	72	47.6	136	70.5	149
2006	59	126	56	132	48	78	49	80	15.9	62.2	20.0	65.2
2007	80	146	80	152	56	88	57	92	42.0	65.9	40.2	65.2
2008	90	200	83	198	65	112	64	112	28.0	78.8	40.2	76.4
2009	86	209	77	204	60	97	61	99	29.1	115	39.8	106
overall	77	167	72	169	58	93	82	95	32.5	80.5	25.6	77.9

Averages of total consumers' surplus for firms

Columns based on specifications from table 2 and assume $\mu = 5.547$.

6 Conclusion

The Bertrand differentiated product model provides us with insights into the current debate about for-profit and non-profit MFIs. Results suggest that allegations against for-profit MFIs by critics are only partially true, in the sense that both loan balances and interest rates are greater, but a more extensive analysis uncovers more subtle issues for discussion. Even after

controlling for the interactions between firms and the different costs each firm faces, the demand for loans from for-profit MFIs is higher due to the consumer's unobserved preferences for loans. The interest rate charged by for-profit MFIs and the implicit demand generates more consumer surplus per loan and more total consumer surplus per firm for the average for-profit than the average non-profit MFI.

Our model helps explain why interest rates may differ between firms in the same market through the use of product attributes. For-profit status and the women-to-borrower ratio capture some unobservable preferences of consumers. Indeed, this analysis may even indicate that consumers have a positive preference for the lower transaction costs of obtaining a loan and prefer individualized loans rather than group loans.

Additionally, this model allows for an analysis of the effects of price setting alone as compared to existing empirical models that do not differentiate between the effects of firms setting prices and choosing quantity. Existing models do not take into account the unobservable attributes in the demand equation and instead rely only on the differences in cost and prices. A possible extension to the research would be to estimate the impact of other attributes, strengthening the robustness checks of the model.

One possible policy recommendation is for governments to set up credit agencies that collect data on consumers' credit worthiness and share this with other MFIs. This could help overcome the lack of information on the consumer's credit worthiness, thereby enabling MFIs to offer lower interest rates to customers while reducing the risk level due to unknown customer credit. This could potentially increase both consumer and producer surpluses. Although for-profit MFIs are currently able to generate higher consumer and producer surpluses than non-profit MFIs, the Nash equilibrium occurs only as a result of the strategic interaction between firms.

Consequently, we are not arguing that policies should focus on the pure promotion of for-profit MFIs. Instead, we believe that these results provide support to the argument that the two types of institutions have and can continue to coexist for the benefit of multiple types of consumers in a market. Both types of MFIs appear to provide increased competition to each other. This appears to help lower equilibrium interest rates and potentially increase consumer surplus. Additionally non-profit MFIs may serve a critical role for enhancing market efficiency.

As noted by Hansmann (1980), non-profit organizations can act as insurance from stochastic shocks to the market that cause for-profit institutions to reduce supply during periods of capital market instability. Non-profit MFIs therefore can play a critical role in ensuring that the poor receive continued access to financial services during events when for-profit MFIs are unwilling or unable to provide access.

A potential empirical improvement would be to obtain consumer-level data, since that would allow us to have more information on the exact structure of loans. A further extension to the research would be to use data on the value of subsidies provided to some non-profit firms. The value of these subsidies could potentially impact marginal cost, a key component used in the estimation of equilibrium prices. Taking away subsidies from non-profit MFIs could result in these MFIs charging higher interest rates. This could also result in higher Nash equilibrium prices for all firms in the market due to the strategic interactions between firms seen in Figure 5 and ultimately lower consumer surplus. An additional avenue of future research would use spatial analysis to recover measures of heretofore unobserved measures of transaction costs. Clearly unobserved heterogeneity exists in our empirical specifications, as evidenced by the strength of our random effects results. Pinning-down the sources of these latent effects could help policy makers target credit access programs to the poor better and further increase market efficiency.

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8 Appendix

8.1 Derivation of $\tilde{\mu}$

The cross price elasticity, ϵ_j , is determined to be 0.25 based on empirical evidence (Hollo, 2010). For purposes of tractability, we assume that the cross price elasticity is constant. Because we do not have data on the consumer level, we use the mean quantity and interest rates to compute the change in quantity. Based on the mean interest rate of 36.6%, we back-out the cross-price effect of a one percentage point change in j 's interest rate by

$$0.25 * \frac{1}{36.6} = \frac{\Delta q_i}{q_i} \quad (6)$$

Since the mean loan size equals \$812, we expect that $\Delta q_i = 5.547$. Therefore when the interest rate of firm j increases by one percentage point, the quantity demanded from firm i increases by 5.547. This is the estimate used for $\hat{\mu}$ in the first four columns of tables 2 and 3 and all results shown in tables 4 and 5.

Figure 1: Comparison of average loan balance per borrower (\$)

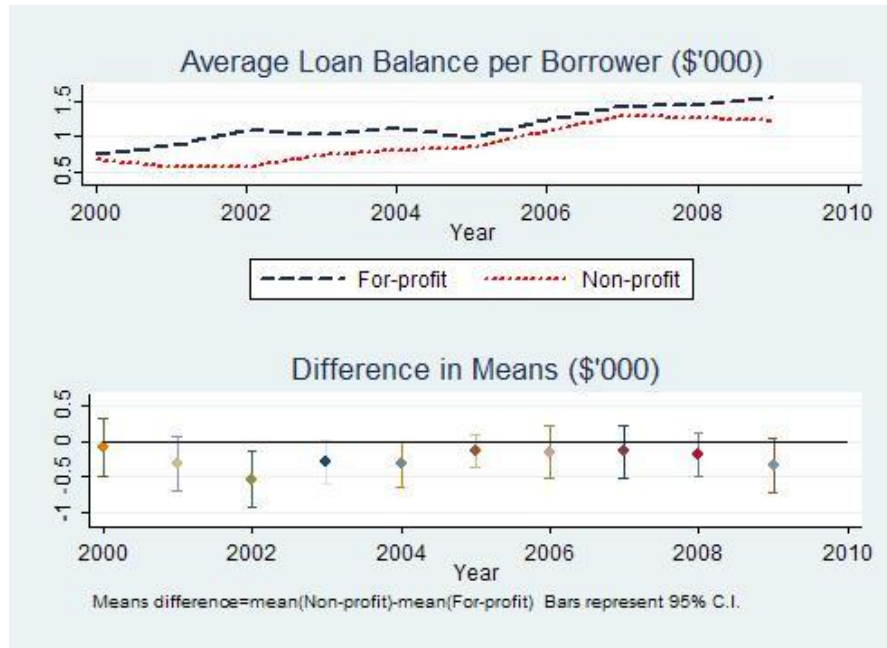
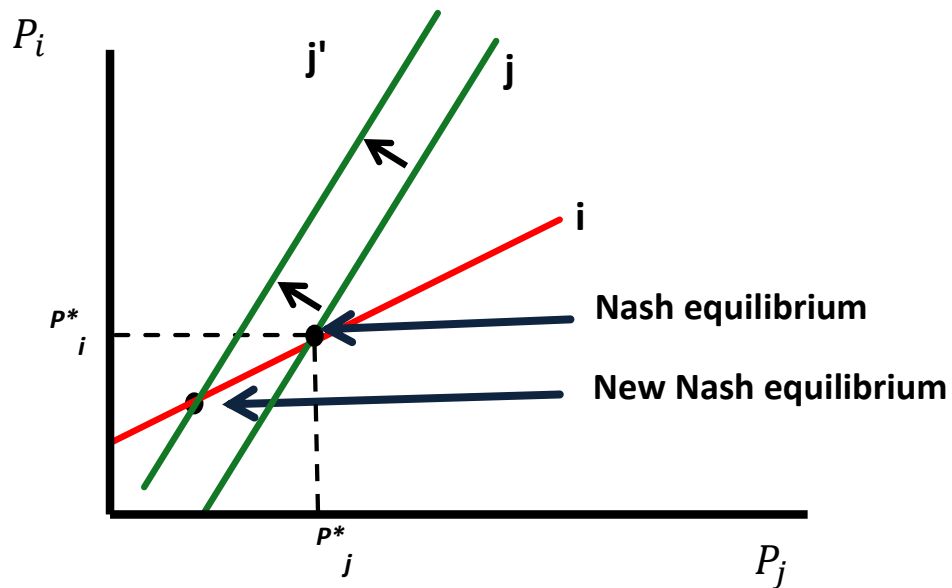


Figure 2: Representation of best response functions



8.2 Alternative Regressions

Table A2 includes alternative estimates to table 2, allowing for the intercept to vary with time.

Table A2: Interest Rates with Time Fixed Effects

Variable	(1) OLS	(2) FGLS	(3) OLS	(4) FGLS
Marginal cost, firm i	54.73*** (2.387)	41.17*** (2.815)	54.57*** (2.346)	40.44*** (2.773)
Marginal cost, j firms	25.89*** (2.380)	16.35*** (2.444)	24.72*** (2.360)	14.957*** (2.485)
For-profit, firm i	0.759 (0.479)	2.049** (0.880)	1.026** (0.473)	2.287*** (0.874)
For-profit, j firms	2.681*** (0.834)	1.910 (1.204)	3.856*** (0.867)	2.153* (1.225)
Women/borrowers, firm i	0.108*** (0.011)	0.102*** (0.012)	0.110*** (0.010)	0.100*** (0.011)
Women/borrowers, j firms	-0.066*** (0.014)	-0.043*** (0.016)	-0.062*** (0.016)	-0.043** (0.017)
Africa	-	-	-1.814*** (0.659)	0.647 (1.195)
Europe	-	-	2.900*** (0.761)	0.869 (1.305)
North America	-	-	4.908*** (0.659)	7.957*** (1.256)
South America	-	-	1.799*** (0.540)	1.707* (0.932)
year 2004	0.488 (1.120)	-0.428 (0.809)	-0.047 (1.209)	-0.530 (0.817)
year 2005	-1.275 (1.047)	-1.362* (0.702)	-1.574 (1.066)	-1.468** (0.715)
year 2006	-2.513** (1.016)	-1.813*** (0.702)	-2.637*** (1.029)	-1.920*** (0.712)
year 2007	-1.783* (0.982)	-1.240* (0.691)	-1.935* (0.997)	-1.398 (0.700)
year 2008	-1.840* (0.960)	-0.777 (0.682)	-1.996** (0.978)	-0.891 (0.693)
year 2009	-2.868*** (0.965)	-2.004*** (0.694)	-3.128*** (0.983)	-2.142*** (0.705)
Constant	12.368*** (1.245)	15.837*** (1.405)	11.017*** (1.522)	14.764*** (1.690)
R-squared	0.562	0.559(overall) 0.610(between) 0.159(within)	0.582	0.563(overall) 0.615(between) 0.160(within)
Breusch-Pagan χ^2	-	1557***		1480***
Observations	3156	3156	3156	3156
Groups		895		895

Notes: Robust standard errors in parentheses.

*significant at 10% **significant at 5% ***significant at 1%

FGLS estimations include institution-specific random effects

The year 2003 serves as the base reference year

“Asia” serves as the reference group for estimates with continent effects

8.3 Sensitivity of Consumer Surplus to μ

Results presented in tables 4 and 5 are based on the assumption that the slope of the cross-price demand equals 7.43. Here we allow for alternative measures of μ . The reader should notice that measures of consumer surplus are scalar multiples of the value for μ . As such, the percentage differences between the for-profit and non-profit measures of consumer surplus do *not* change as μ scales.

Table A4: Average consumer's surplus per loan, (\$)

	<i>for-profit MFIs</i>				<i>non-profit MFIs</i>			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
$\mu = 1$	180.2	308.6	178.2	329.1	170.4	240.1	177.7	264.1
$\mu = 4$	720.8	1234.2	712.9	1316.0	681.6	960.5	710.7	1056.4
$\mu = 7$	1261.4	2159.9	1247.5	2303.1	1192.9	1680.9	1243.7	1848.7
$\mu = 10$	1802.0	3085.5	1782.2	3290.1	1704.0	2401.2	1776.7	2641.1

Table A5: Total consumers' surplus per firm, (\$ million)

	<i>for-profit MFI average</i>				<i>non-profit MFI average</i>			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
$\mu = 1$	14	30	13	30	10	17	11	17
$\mu = 4$	55	121	52	122	42	67	42	68
$\mu = 7$	97	211	91	214	73	117	73	120
$\mu = 10$	138	302	130	305	104	167	105	171

Averages of total consumers' surplus for firms