Strategic Research Area for Sustainable Development in East Asia
Research Center for Sustainable Development in East Asia
埼玉大学東アジアSD研究領域・東アジアSD研究センター

Discussion Paper series

SU-RCSDEA 2022-001

What Explain High Interest Rates in Microfinance Loans? Evidence from the Case of a Newly Introduced Interest Rate Cap Policy in Cambodia

Daiju Aiba

JICA Ogata Sadako Research Institute for Peace and Development, Japan

Sovannroeun Samreth

Saitama University, Japan

What Explain High Interest Rates in Microfinance Loans? Evidence from the Case of a Newly Introduced Interest Rate Cap Policy in Cambodia[†]

Daiju Aiba[a], Sovannroeun Samreth[b]

[a] Corresponding author. JICA Ogata Sadako Research Institute for Peace and Development, Japan. E-mail: aiba.daiju@jica.go.jp
[b] Saitama University, Japan. E-mail: roeun99@mail.saitama-u.ac.jp

February 2022

Abstract

Microfinance loans are generally set at high interest rates. However, empirical evidence on the pricing behavior of microfinance loans is still scarce. Our study provides evidence of the determinants of interest rates on microfinance loans by examining how microfinance institutions (MFIs) adjusted to the introduction of the interest rate cap policy in the case of Cambodia. First, we find that loan size per borrower was an important factor in determining effective interest rates in Cambodian MFIs, as increases in loan size contributed the most to the decline in the effective interest rate of MFIs after the introduction of the interest rate cap policy. Second, we find that the time effect was one of the largest contributors to the decline in effective interest rates, suggesting that the decline in market power was significant after the interest rate cap policy. Third, cost factors such as labor and funding prices are significantly correlated to the interest rate. Apart from the interest rate cap policy, MFIs have struggled to adjust to increased labor prices in recent years. Fourth, increasing the number of borrowers did not correlate with the effective interest rate, suggesting that increasing outreach does not necessarily lead to a reduction in the price of microfinance loans in Cambodia. Lastly, we find that average MFIs kept the loan provision to rural areas and to women borrowers, even after the interest rate cap policy.

Keywords: Microfinance, Interest rate, Interest rate ceiling, Pricing behavior, Cambodia

JEL Classification: G12; G21; G28

[†] This research is a part of the project "The Study on the Promotion of Financial Inclusion in Cambodia" by JICA Ogata Research Institute. It is also partially supported by the Grant-in-Aid for Scientific Research (C), No. 18K01641 and No. 18K01604. We are solely responsible for any errors that may appear in this paper. Any result discussions and interpretations in this study are ours and do not reflect the views of the authors' affiliated institutions.

1. Introduction

In recent decades, microfinance institutions (MFIs) have attracted the attention of policymakers, researchers, and social investors. MFIs were originally established to provide financial products for poor households and help in alleviating the poverty rate. However, emerging problems have also been reported in the MFI sector. One problem is the high interest rates set by MFIs (Brickell et al., 2020). High interest rates on loans often lead to over-indebtedness in some countries. To reduce the debt burden for borrowers and prevent unfairly high interest rates, governments commonly rely on an interest rate cap policy in both developing and developed countries (Maimbo and Gallego, 2014). However, there have been concerns about the reduction in financial inclusion in developing countries due to the implementation of said policy. Therefore, understanding the pricing behavior of microfinance loans is important from the perspectives of both financial inclusion and consumer protection.

There is a vast body of literature on the pricing of microfinance loans. Some studies suggest that the high interest rates set by MFIs could be a consequence of market power (Baquero et al., 2018). In other words, MFIs exploit borrowers' welfare due to low competition and information asymmetry and cause allocative inefficiency in the market. In addition to allocative inefficiency, a low-competitive environment could also allow MFIs with inefficient management to survive in the market, leading to a high interest rate in the microfinance loan market. Furthermore, there is another possible explanation for high interest rates. MFIs were originally established to lend to people who were excluded from the traditional banking sector. MFI borrowers are therefore likely to live in rural areas and have low repayment ability. Thus, the costs involved in lending are large as percentages of the size of granted loans for MFI borrowers (Stiglitz and Weiss, 1981; Dorfleitner et al., 2013; Cull et al., 2018). In particular, fixed costs per loan are large for microloans due to monitoring costs and transportation costs; thus, lowering the interest rate level by a cap policy could make it difficult for MFIs to maintain loan provision to costly, poor borrowers.

Therefore, an investigation into the determinants of the interest rate of microfinance loans is needed to appropriately design regulations and policies in the microfinance sector. Studies on the regulation of MFIs have exclusively focused on the impact of regulatory changes on the market power of MFIs (Baquero et al., 2018). However, apart from market power, regulatory changes also affect profit margins, cost structures, and MFI lending policies at the same time. Therefore, it is important to investigate how MFIs adjust to regulations by changing their lending and management policies. For instance, in response to the interest rate cap policy, some Cambodian

MFIs shifted their customer bases toward urban areas, while other MFIs reduced operational costs by adopting different lending technologies (Aiba et al., 2021). Since the adjustment of cost structure and resource allocation could affect financial inclusion, the negative side effects of regulation should be considered in the implementation.

In this study, we develop a model of pricing interest rate on microfinance loans to disentangle the determinants of the same and estimate the model by collecting data on Cambodian MFIs from various sources. To estimate pricing behavior, we consider endogenous bias from borrowers' demand factors. Specifically, there is a possibility of endogeneity between the interest rate and the aggregated number of borrowers, as well as between the interest rate and loan sizes per borrower for each MFI. To address this issue, we use demand-shift factors as instrument variables for endogenous variables.

Our study analyzes the determinants of interest rates by investigating how MFIs were adjusted to the interest rate cap, which was recently introduced in the Cambodian microfinance sector. In April 2017, an interest rate cap policy was introduced in Cambodia's microfinance sector. After the imposition, Cambodian MFIs were forced to decrease the interest rates set on new loan disbursements or refinanced loans by not more than 18% on an annual basis. According to the National Bank of Cambodia (NBC), this policy was introduced to drive inefficient MFIs from markets and decrease debt burdens for borrowers. However, according to Samreth et al. (2021), the average interest rate for borrowers in rural areas was higher than 18% before the interest rate cap policy was introduced. Thus, most MFIs struggle to decrease their interest rates by changing their lending and financing policies. This drastic change in the regulation of MFIs allows us to investigate the biggest factor determining the interest rates of MFIs. We investigate how MFI management characteristics changed after the establishment of the interest rate cap policy and assess which factors affected the decline in the interest rates of MFIs.

From this analysis, we highlight the following results. First, we find that loan size per borrower was an important factor for determining interest rates in Cambodian MFIs, as increasing loan sizes can explain the largest part of the decline in the average effective interest rate of MFIs after the introduction of the interest rate cap policy. Second, we find that the year-fixed effect is also one of the largest factors in the decline in effective interest rates, suggesting that the decline in market power was significant after the interest rate cap policy. Third, the prices of cost factors in MFIs are also important in deciding the interest rate, as labor and funding prices are significantly correlated to the interest rate. In particular, we also find that labor prices have been a huge pushing factor for interest rates in recent years, apart from the interest rate cap policy.

Fourth, we find that increasing the number of borrowers does not necessarily decrease interest rates, suggesting that simply scaling up microfinance operations does not necessarily lead to a reduction in Cambodia's interest rate. This result might imply that economies of scale might not be properly realized in terms of the number of borrowers. Lastly, we found that average MFIs maintained the loan provision to rural areas even after the interest rate cap policy.

Our study contributes to the literature on the determinants of interest rates in microfinance loans in three ways. First, we develop an empirical model based on a theoretical consideration of the pricing behavior of MFIs. Several studies have examined the determinants of interest rates on microfinance loans (Dorfleitner et al., 2013; Cuéllar-Fernández et al., 2016). However, these studies do not necessarily consider pricing behavior in consideration of the maximization of the objective function of MFIs and also in consideration of the cost structure. For example, Dorfleitner et al. (2013) show that the ratio of operating costs to outstanding loans is highly correlated with interest rates in a global sample of microfinance. However, from a theoretical perspective, costs depend on the functional form and are determined by the prices of the cost factors and production amounts. Furthermore, their analysis lacks a discussion of the endogeneity problem in the estimation of the pricing function. Discussing cost structures based on an economic model is crucial for policymakers to determine the optimal interest rate cap in consideration of the possible side effects of outreach. Thus, these previous studies suffer from the interpretation of estimated results based on economic theory. In this regard, we develop a theoretical model for pricing microfinance loans and then select variables for estimation, such as credit risk factors and marginal costs of lending. We also discuss an empirical method to address the endogeneity issue in the estimation using the demand factor as an instrumental variable.

Second, we provide evidence that the interest rate of microloans decreases with increasing loan size per borrower, but does not decrease with an increase in the number of borrowers. Hartarshka et al. (2013) also examined the existence of economies of scale with a global sample of MFIs by estimating the cost function, and they found statistical evidence on economies of scale. However, their model does not consider that adjusting the loan size per borrower is also a significant factor in determining marginal cots because there are large fixed costs in lending each loan (Armendariz and Morduch, 2005). For MFIs, it is also an option to provide small loans to more borrowers or larger loans to fewer borrowers. In contrast, our empirical model considers that marginal costs change in response to changes in the number of borrowers and average loan sizes per borrower, and finds that simply increasing the number of borrowers does not lead to a decrease in the interest rate, but increasing the loan size can lead to a decrease in the interest rate,

possibly due to a decrease in the marginal costs of lending.[1]

Lastly, our estimation uses a single-country sample of Cambodian MFIs exploiting variable data sources, while other studies mostly use a global sample of MFIs from the MIX Market database. The MIX Market database has the advantage of collecting large-scale samples; however, there are many missing samples of MFIs because the data are reported on a volunteer basis (Bauchet and Morduch, 2013). For example, after Green Central Micro Finance was acquired by South Korean Financial Groups in 2016, it stopped reporting financial statements to the MIX Market. Thus, the sample from the MIX Market database could cause bias in the estimation of the pricing function of microfinance loans. Furthermore, there could be a problem in the definition of the variables that represent the distribution of loan disbursements of MFIs, such as rural loans. The definition of rural areas could vary from country to country and MFI to MFI.

The remainder of this paper is organized as follows. Section 2 reviews the literature on interest rates of microfinance loans. Section 3 describes the institutional background of the interest rate cap policy and provides an overview of Cambodian MFIs. Section 4 presents empirical models and describes the data. Section 5 presents the empirical results. Finally, Section 6 concludes the study.

2. Literature review of determinants of interest rates of micro loans

Most microfinance studies have focused on the trade-off between social performance and sustainability. Using cross-country MFI samples from the MIX database, Herms et al. (2011) estimate the cost function and find a negative correlation between cost efficiency and the average loan size. In a recent study, Quayes (2021) used longitudinal MIX data spanning 2003 to 2018 and found a negative correlation between average loan size and return on assets. Hossain et al. (2020), using 4,576 MFI-year observations (1,139 unique MFIs) from 59 countries over the period 2005-2014, document that competition has a negative effect on the economic sustainability of MFIs. These studies suggest that there are significant costs in extending microloans in developing countries, and that MFIs face a trade-off between outreach and sustainability.

Meanwhile, studies on interest rates on microfinance loans are still limited. In the literature on traditional financial institutions, such as commercial banks, there is plenty of prior research on

[1] Furthermore, estimation of the cost function could have a problem in the measurement of total costs. Theoretically, the cost should take into account the opportunity costs, rather than costs from accounting cost. Our approach avoids this problem by estimating the pricing function of the MFI loans.

lending interest rates. Generally, traditional financial institutions set interest rates based on (1) cost structure, such as funding and operational costs, and (2) characteristics of loan portfolios, such as credit risks and maturity structure (Entrop et al., 2015). Similar to other ordinary industries, market conditions also matter in the banking sector. The market power of financial institutions (i.e., competitiveness) determines how much financial institutions profit by setting high interest rates (Saunders and Schumacher, 2000; Maudos and Guevara, 2004; Gambacorta, 2008). Furthermore, Saunders and Schumacher (2000) empirically find that apart from credit risks, the intensity of regulations on financial institutions also affects interest rates.

However, the business models of MFIs differ from those of traditional financial institutions. In particular, the objective of MFIs was originally to achieve poverty reduction by lending to people who are excluded from traditional financial institutions. Thus, MFI borrowers generally have high credit risk in terms of availability of collateral and lack of stable income sources. Furthermore, MFI borrowers are located in distant areas where MFIs incur high physical costs, such as monitoring and transportation. Thus, setting higher interest rates is necessary to cover the costs and risks of MFI lending. McIntosh and Wydick (2005) provided a theoretical analysis to explain how social-oriented MFIs expand their outreach. The model shows that MFIs engage in cross-subsidization across clients to reach the poor at lower interest rates to maximize outreach while maintaining sustainability. In other words, MFIs compensate for the loss from lending to people with low repayment ability and profit from lending to people with high repayment ability. According to the model, competition would decrease the profitability of MFIs, and subsequently MFIs would reduce outreach.

In the empirical literature on interest rates set by MFIs, Dorfleitner et al. (2013) investigate the determinants of interest rates of MFIs using data from 679 MFIs from the MIX Market database. They examine whether MFIs follow Rosenberg's (2002) formula and assess the effects of gender discrimination, regulation, lending methodology, and organizational type. Rosenberg's formula is a simple method for MFI practitioners to calculate interest rates at a sustainable level. In Rosenberg's formula, interest rates are calculated based on account-based costs and predicted loan-loss provisions. Dorfleitner et al. (2013) find that the interest rates of MFIs are not necessarily explained by Rosenberg's formula, and that the ratio of operating expenses to total loans seems to be the main driver of interest rates. By investigating the interest margins of MFIs, Cuéllar-Fernández et al. (2016) also find evidence that operating expenses are the main driver of interest margins.

Regarding the discrimination of women, several studies find a positive correlation between

interest rates and the ratio of women borrowers (Dorfleitner et al., 2013; Cuéllar-Fernández et al., 2016). However, there does not seem to be a consensus about whether MFIs put a premium on female borrowers. Some studies document evidence that the repayment rates for female borrowers are relatively higher than that for men (D'Espallier et al., 2011; D'Espallier et al., 2013). However, in the analysis of the efficiency of MFIs, Hermes et al. (2011) find a positive relationship between the ratio of female borrowers and inefficiency in management. Thus, there is a possibility that the correlation between high interest rates and the ratio of female borrowers reflects MFI-specific inefficiencies.

Several studies have focused on the effects of competition on the interest rates of MFIs. Using rating reports of MFIs in each country from rating agencies, Baquero et al. (2018) investigate the effects of competition on the interest rates of non-profit and for-profit MFIs. They find that the effect of competition is more pronounced in for-profit MFIs. Similarly, Dorfleitner et al. (2013) empirically show that regulated MFIs are likely to set lower interest rates than their non-regulated peers.

There is also a vast body of literature on the relationship between governance, organizational types, and MFIs. Barry and Tacneng (2014) investigate whether shareholder-owned MFIs outperform non-government organizations (NGOs) using data from 289 MFIs in sub-Saharan Africa from 2001 to 2007. They find that NGOs were more profitable and performed better in terms of both the depth and breadth of outreach. There are also studies on differences in interest rates of MFIs across organizational types using cross-sectional data of 358 MFIs in 2009, and Robert (2013) documents the evidence that interest rates are on average higher for for-profit MFIs. Baquero et al. (2018) find a composition effect on interest rates in which interest rates of non-profit MFIs have increased over the period due to the transformation of efficient non-profit MFIs into for-profit MFIs.

Apart from traditional financial institutions, MFIs depend on international lenders for their funding sources, which are usually denominated in foreign currency. Thus, even though the funding price is low, significant currency risk could exist in the balance sheets of the MFIs. Al-Azzam and Mimouni (2017), using the data of currency denomination of MFIs from several countries, document the evidence that there is a premium on the interest rates on microfinance loans of MFIs with currency risks.

Most studies in the literature on interest rates of MFIs obtain data from the MIX Market. The database contains rich information on balance sheets, income statements, and MFI characteristics that can be used to evaluate the outreach and sustainability of MFIs. In addition, the database has

the advantage of covering a global sample of MFIs, such that it is useful for analyzing the impact of country-level factors, such as regulations and macroeconomic policies. However, the database was voluntarily reported by the MFIs or their relevant organizations. Therefore, Bauchet and Morduch (2013) point out that MFIs available in the database are likely to be biased toward socially-oriented ones. In addition, some MFIs stopped reporting to the MIX Market after changing their policies. Therefore, there could be selection bias in the estimation using data from the MIX Market.

Our study focuses on Cambodia. One of the advantages of focusing on Cambodia is the smaller selection bias in the data, since we collect data from all registered MFIs in Cambodia. Another advantage is the availability of more comprehensive information about MFIs' operations than in the MIX Market. Focusing on a single country allows us to collect data from various sources to measure MFI activity.

3. Overview of the microfinance sector in Cambodia

In the Cambodian microfinance sector, regulated, shareholder-owned MFIs play an important role in reaching the poor rather than non-government organizations. The Cambodian banking sector is regulated by the National Bank of Cambodia (NBC). The banking sector comprises commercial banks, specialized banks, microfinance institutions (MFIs), and registered credit operators. According to the NBC (2018), as of 2018, there were 39 commercial banks, 15 specialized banks, 76 microfinance institutions (MFIs), 313 rural credit institutions, and 11 financial lease companies. Under the regulations of the NBC, financial institutions that have loan assets of more than one billion riels must acquire a microfinance license. However, even if their assets are small, financial institutions are encouraged to register as credit operators.[2] The MFIs were further divided into seven deposit-taking microfinance institutions (MDIs) and 69 non-deposit-taking microfinance institutions (non-MDIs). There are several regulatory differences between MDIs and non-MDIs, such as the minimum capital requirement, solvency ratio, and liquidity ratio. The minimum capital requirement is USD 30 million for MDIs, and 1.5 million for non-MDIs. The minimum solvency and liquidity ratios for MDIs were 15% and 70%, respectively. MDIs were required to maintain a reserve requirement ratio of 8%. Rural credit institutions are generally small NGOs that normally operate in rural areas. They receive loans

[2] For the detailed description of microfinance institutions in Cambodia, see Aiba and Lam (2019).

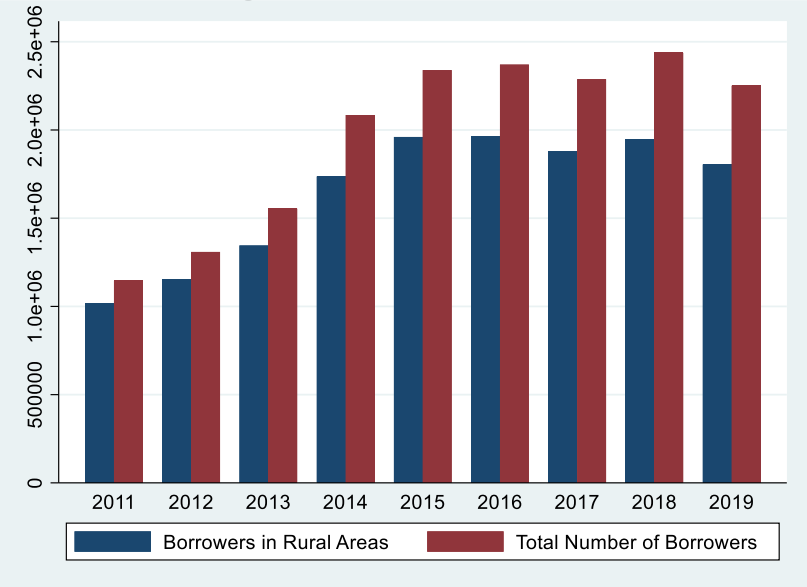
from MDIs and non-MDIs to provide credit to rural households.

An interest rate cap policy was announced on March 3, 2017, and has been implemented since April 1, 2017 (NBC, 2018). According to the NBC (2017, 2018), the regulation requires MDIs, non-MDIs, and rural credit institutions under the supervision of the NBC to set the interest rate on loans to not exceed 18% per year for any maturity. This interest rate ceiling is applied for new credit contracts as well as restructured loans and refinancing, which requires institutions to comply from April 1, 2017. The interest rate cap policy initially aimed at improving market efficiency by dumping inefficient MFIs from the market (IMF, 2017). As of 2019, no MFIs have withdrawn from the market because of the interest rate cap, but several MDIs and non-MDIs have been acquired or merged with other financial institutions and/or non-financial institutions.

The government may also expect that the introduction of an interest rate cap policy will reduce the debt burden on households. In fact, there were concerns about the over-indebtedness of predatory lending in the MFI sector. The average amount of loans has been increasing rapidly, while the increase in SME and mortgage loans has contributed to increasing loan sizes. Although the interest rate cap can reduce the debt burden for such households, it was too low for MFIs to keep lending to the poor. Before the interest rate cap policy was implemented, the average interest rate for MFI borrowers in rural areas exceeded 18% (Samreth et al., 2021).

Figure 1 shows the number of borrowers in rural areas and the total number of borrowers over time. Consistent with Aiba et al. (2021), the total number of borrowers in rural areas declined after the interest rate cap policy, while the total number of borrowers remained at the same level. This suggests that MFIs modified their policy to lend to borrowers in urban areas due to high costs and risks in lending to borrowers in rural areas.

Figure 1: Number of borrowers

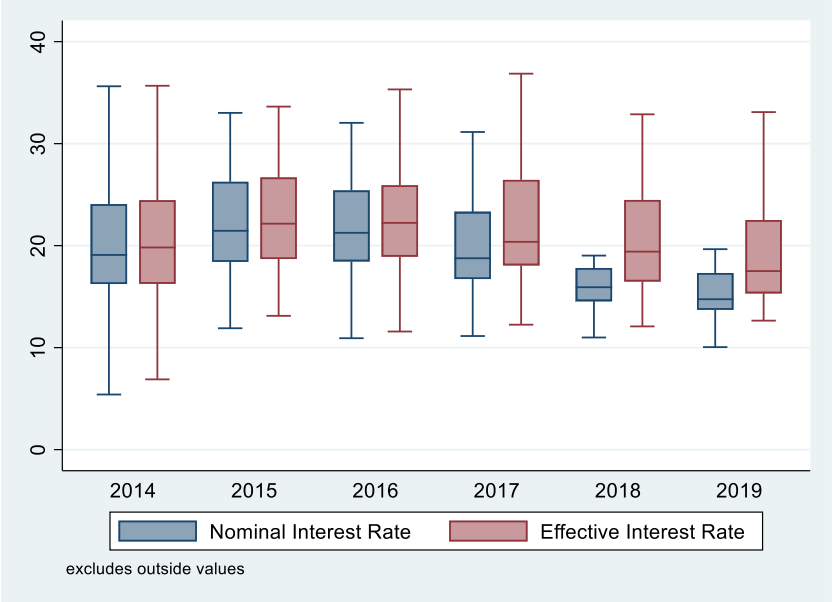


Note: Author's calculation based on CMA-NIX.

Figures 2 and 3 show the estimated average nominal interest rates and the effective interest rates of the MFIs. We collected these data from the NBC Annual Supervision Reports and calculated nominal interest rates and effective interest rates for each of the MFIs in the reports. Nominal interest rates are defined as interest income divided by the loan amount. Effective interest rates are defined as the sum of interest and non-interest income divided by the amount of loans. However, there are caveats in the interpretation of these measures of the average interest rates of each MFI, even though the measure is easy to obtain from open public data sources. If loan amounts increase in a year, this measure underestimates the actual interest rate. However, if loans decrease in a year, this measure would overestimate the actual interest rate. This deviation from the actual average interest rates comes from the difference in definition between interest income in an income statement and loans outstanding on a balance sheet. The income statement presents the total amount of income and expenses during a year, whereas the balance sheet presents the amount of assets and liabilities at the end of the fiscal year.

Figure 2 shows the time trend of the median of the nominal and effective interest rates. The interest rates declined after the interest rate cap policy. The data used in this study are from a balanced panel. We dropped MFIs that did not continuously exist in the data from 2014 to 2019. The median of the interest rate continuously decreases after the policy change, and the median of the effective interest rate also decreases. Thus, although there could be loopholes for MFIs, it is still likely that this policy change would affect MFI lending behavior.

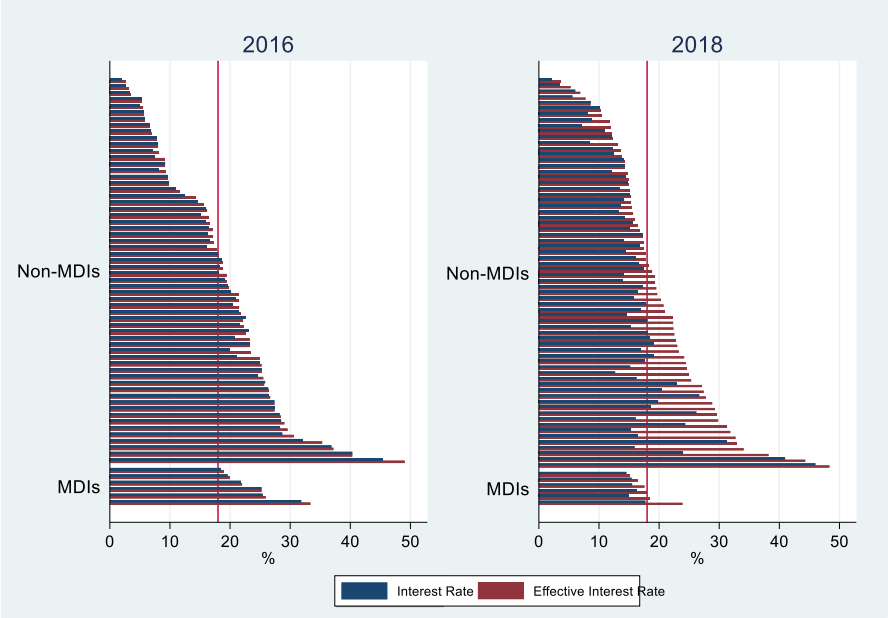
Figure 2: Changes in nominal interest rate and effective interest rate



Note: Balanced panel data between 2014 and 2019

Figure 3 shows that the average interest rates were higher than 18% for half of the MFIs in 2016, while most lowered average interest rates to below 18% in 2018. In 2016, there was no significant difference between nominal and effective interest rates, suggesting that MFIs earned revenue primarily through interest income before the interest rate cap policy was implemented. However, in 2018, the nominal and effective interest rates were decoupled for most non-MDIs. Even after the implementation of the interest rate cap policy, some non-MDIs maintained effective interest rates at the same level by increasing their non-interest income. The results suggest that non-MDIs try to offset the impact of the interest rate cap policy by increasing fee charges on loans. There is much anecdotal evidence suggesting such a practice is prevalent for non-MDIs. In addition, the NBC announced that it would conduct on-site audits of the fees charged to ensure that the fees are not “unfairly” high (NBC, 2018).

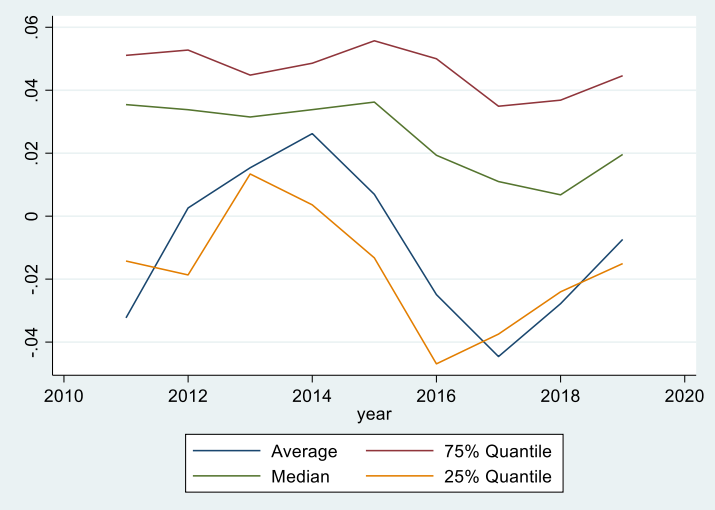
Figure 3: Average interest rate and average effective interest rate before and after the policy introduction



Source: Authors' calculations using the NBC supervisory annual report 2016 and 2018.
Note: The estimation of average interest rates sometimes deviates from the actual interest rate they impose on consumers if loan amounts change a lot within a year. To avoid misleading readers, we removed those MFIs whose average interest rates exceeded 50% in both 2016 and 2018.

Figure 4 shows the trend of ROA in MFIs. The average and medium ROA both decreased in 2017, although the decline started in 2016. The ROA began to recover in 2018. This suggests that the MFIs started adjusting to changes in their operational environments.

Figure 4: Trend of ROA between 2011 and 2019



Source: Authors' calculations using the NBC supervisory annual report 2011 and 2018.

4. Methodologies

4.1 Empirical model of pricing loans by MFIs

Interest rates are set to cover the costs and risks of lending, such as credit risks, operation costs, and funding costs. To examine the factors that affect the interest rates of MFIs, in this section we develop the empirical models that explain them. We assume that MFIs operate under monopolistic competition. There are two geographically distinct markets; urban and rural. The demand functions of borrowers in each market are denoted as $r_k = r_k(L)$, where the subscript k represents whether the area is urban (k=1) or rural (k=2). We denote default risk as δ_k, and assume that the default risk is higher in rural markets than in urban areas, $\delta_2 > \delta_1$. We suppose the cost function of MFIs is $C(L, w, i)$, where L represents the number of loans, w is the labor price, and i is the funding price. The MFI's profit function can then be denoted as $\Pi = \Pi_1 + \Pi_2 = (r_1 - \delta_1)L_1 - (r_2 - \delta_2)L_2 - C(L, w, i)$. We also assume that the MFI's objective is to maximize the number of loans in rural areas (L_2) with non-negative profit constraints, so that the MFI needs to satisfy $\Pi + \mathrm{G} \geq 0$ (G is subsidy).

Using the Lagrange multiplier (μ), the maximization problem of an MFI is denoted as follows:

$$\max_{L_1, L_2} \mathcal{L} = L_2 + \mu(\Pi + \mathrm{G})$$

The first order conditions are obtained as:

$$r_1 = -r_1' L_1 + \delta_1 + mc \quad (1)$$

$$r_2 = -r_2' L_2 + \delta_2 + mc - \frac{1}{\mu} \quad (2)$$

The aforementioned equations represent the MFI's pricing behavior in markets 1 and 2, respectively. Due to the low income of households in rural areas, the slope of the demand function could be higher in Market 2 than in Market 1 ($-r_1' < -r_2'$), meaning that the market power in rural areas could be higher. However, if MFIs maximize the number of borrowers in rural areas and engage in cross-subsidization, the interest rates could be set at a lower level in Market 2 because $-\frac{1}{\mu}$ is included in Equation 2.

From Equations 2 and 3, we obtain the following pricing equation for the average interest

rate:

$$\frac{L_1 r_1 + L_2 r_2}{L} = \frac{\Sigma \omega_k}{1 + \epsilon_k}(\delta_k + \ mc) - \frac{\omega_2}{(1 + \epsilon_2)\mu} \tag{3}$$

where $\omega_k = \frac{L_k}{L}$, and $\epsilon_k = \frac{r'_k L_k}{r_k}$. Thus, the average interest rate can be denoted as the sum of the weighted average of demand elasticity (ϵ_k), credit risks (δ_k), and marginal costs of lending to additional borrowers (mc), in addition to the degree of cross-subsidization ($\frac{1}{\mu}$). This pricing equation suggests that the average interest rate increases in the ratio of rural loans, average market power, average credit risks, and marginal costs. Furthermore, the degree of cross-subsidization decreases the average interest rates, as it decreases the interest rate in rural areas.

In the estimation of determinants of interest rates, we consider the possible factors from the theoretical model above. We integrate the possible factors affecting interest rates into a linear model as follows:

$$R_{it} = \ \alpha + \Sigma \beta_k CF_{kit} + \Sigma \gamma_j mc_{jit} + \psi_t + f_i + \epsilon_{it}, \tag{4}$$

where R_{it} is the average interest rate at MFI level. The subscript *i* represents the MFI and *t* represents the period. CF_{it} is the vector of the loan portfolio characteristics of MFIs, which represents the differences in credit risks among MFIs. Some MFIs concentrate on lending to rural areas and women to achieve social objectives, while others focus on making profits and continuing to lend in urban areas. These differences reflect the credit risks in the clientele of the MFIs. mc_{jit} represents the factors in the marginal cost function, such as funding and labor prices. We also capture the MFI-specific fixed effect by including f_i, which captures both inefficiency in management and degree of cross-subsidization.

ψ_t is a time-fixed effect that captures the effects of macroeconomic factors (e.g., changes in regulation, competition, and economic growth) on the market power of MFIs. Macroeconomic factors could affect the interest rate indirectly by changing the credit and operational factors of MFIs but also affect the interest rate directly by reducing market power. ψ_t captures the direct effect of macroeconomic factors on the market power of MFIs. To assess competition effects,

some previous studies have used competition indicators such as concentration ratio, Herfindahl Hershman Index, and H-statistics. However, since our study deals with single-country data, the effects of competition could be absorbed in the time-fixed effects.

4.2 Data and selection of variables

Our dataset was constructed from two sources. The first is the NBC Supervisory Annual Report, which includes the financial statements of each financial institution. Another data source is the CMA-NIX, which is a database of the Cambodia Microfinance Association (CMA). The CMA-NIX contains data on the amounts of outstanding loans, deposits, and the number of borrowers and depositors at the MFI-district level pair on a quarterly basis, and covers all the MFIs registered to the CMA. The NBC's data lacks information on the number of borrowers of MFIs and the number of borrowers by gender and area, while CMA-NIX has an advantage in investigating the MFI's loan portfolio in detail. We aggregated each variable of the CMA-NIX at the MFI-level to match the data from the NBC Supervisory Annual Report.

For the proxy of the interest rate set by the MFIs, we adopt the effective interest rate. As is common in other studies of financial institutions, data on interest rates at the loan level are not available in our study. Many previous studies relying on MFI-level data often use the yield on gross portfolios as a proxy for the average interest rate that an MFI charges on its loans (Cull et al., 2007; Tchakoute-Tchuigoua, 2012; Hudon and Traca, 2011; Roberts, 2013). The interest rate was calculated using the following formula.

$$r_{it} = \frac{INTEREST\ INCOME_{it} + NON\ INTEREST\ INCOME_{it}}{LOAN_{it}}$$

The descriptive statistics of the variables used in the estimation are presented in Table 1. For the credit factors, we capture the differences in the borrower characteristics of each MFI by using the ratio of borrowers in rural areas to total borrowers, the ratio of women borrowers to total borrowers, and the ratio of agricultural loans to total loans. These indicators are often used to measure the depth of an outreach (Schreiner, 2002; Barry Tacneng, 2014). To consider the difference in the default risks of borrowers, we also include the ratio of non-performing loans (NPLs) to total loans[3].

[3] Non-performing loans are loans where borrowers are seen as being unable to repay, since they have not

We use first-order approximation to capture the marginal cost function. The marginal cost is approximated by a linear function of input prices and output amounts. For input prices, we include labor and funding prices, which are commonly used in the estimation of the cost function (Hermes et al., 2011). As a proxy for labor prices, we use operating expenses divided by the total number of staff. Owing to data limitations, personnel expenses cannot be separated from operating expenses. However, personnel expenses usually dominate most operating expenses for financial institutions. As a proxy for funding price, we use interest expenses divided by deposits plus borrowings. We also include the total number of borrowers in the marginal cost function. Larger MFIs could have smaller marginal costs, since economies of scale might exist in the microfinance business. In addition, we consider the significant fixed costs for each microfinance loan. There are usually significant fixed costs involved in providing loans to clients in distant areas due to large monitoring and transportation costs. The increase in loan size per borrower leads to a decrease in the proportion of fixed costs to loan amounts per borrower, leading to a reduction in total costs per borrower by including the log of the loan size per borrower.

As mentioned before, our measure of effective interest rates could over-/under-state the actual interest rates set by MFIs if outstanding loans have been decreasing/increasing quickly in the period. To reduce this bias, we also include the year-on-year growth rate of loans from MFIs in the model.

Before running the regression models, we removed several outliers from the data. First, we drop the sample if the effective interest rate exceeds 50%. Second, we drop the sample if the NPL ratio exceeds 60%. Finally, we drop the sample if the ratio of agricultural loans exceeds 100%.

made the scheduled payments for a specified period.

Table 1: Summary Statistics

Variables	Mean	Standard Deviation	Data Source
Effective Interest Rates	21.3	7.1	NBC Supervisory Annual Report
Credit Risk Factors			
Agri Loan/Total Loan	19.0	23.4	NBC Supervisory Annual Report
# of Female Borrowers/# of Borrowe	61.9	19.7	CMA-NIX
# of Borrowers in Rural Areas/# of Bc	52.3	35.3	CMA-NIX
NPL Ratio	50.6	35.8	CMA-NIX
Marginal Cost Factors			
Labor Price	12.3	13.8	NBC Supervisory Annual Report
Funding Price	6.8	22.5	NBC Supervisory Annual Report
Log. Average loan size per borrower	2.4	1.3	CMA-NIX
Log. Number of Borrowers	8.2	2.5	CMA-NIX
Other Factors			
Foreign Share	0.5	0.4	NBC Supervisory Annual Report
Growth Rate of Assets	0.4	0.7	NBC Supervisory Annual Report

Note: Number of observations is 334.

4.3 Endogeneity issues and identification

A simple estimation of the pricing equation could suffer from endogeneity bias. Since the interest rate and the number of loan provisions are determined as the intercourse of aggregate demand and supply functions, the estimation of coefficients of (1) the number of borrowers and (2) loan size per borrower in pricing equation 4 could also reflect the relationship defined by borrowers demanding more loans as the interest rate decreases. However, clients rarely visit MFIs directly and rarely request loans directly. The selection of clients depends on the loan officer's effort to search for and monitor new clients.[4] Thus, we suppose that demand-side factors may not seriously affect loan provisions. However, even though the bias could be small, estimating the coefficients of the number of borrowers is crucial if scale economies realize MFI operations. Therefore, we address this issue by adopting the IV approach.

For the selection of valid instrumental variables for the number of borrowers, demand shift factors that do not directly appear in the pricing equation are the most appropriate. Aggregated demand is determined by regional economic conditions, such as population size, economic development, and the wealth of residents. Because there is variation in the operation areas across MFIs, the aggregated demands that each MFI face is also different across MFIs. Thus, we exploit

[4] Prior studies on interest rate determinants often treat the gross loan portfolio as an exogenous variable (Dorfleitner et al. 2013; Cuéllar-Fernández et al., 2016).

the variations in the operation areas across the MFIs for identification.

The data on population sizes and road lengths are available at the village level, and the number of borrowers at the district level is available for each MFI in the CMA-NIX data. In the following calculation, we create the instrumental variables as a vector Z_{it}, to capture the potential aggregated demand that each MFI faces.

$$Z_{i,t} = \left(\frac{1}{k}\Sigma_k\, \omega_{k,t,i} Pop_{k,t},\ \frac{1}{k}\Sigma_k\, \omega_{k,t,i} LengthRoad_{k,t}\right),$$

Pop_k represents the total population in district k; $LengthRoad_{k,t}$ represents the sum of the length of roads in district k; $\omega_{k,t,i}$ represent the weights of MFI loan allocation by district. Thus, $Z_{i,t}$ is supposed to represent the factors in the aggregate potential demand that each MFI faces in each period. We use the vector $Z_{i,t}$ as the instrumental variables for (1) the number of borrowers and (2) loan size per borrower in the pricing equation. The number of instrumental variables is the same as the number of instrumented variables. Thus, there is no concern regarding the overidentification problem in our identification strategy.

5. Empirical results

5.1. Estimation of determinants of effective interest rate

We estimated the model using fixed-effect ordinary least squares (OLS) and fixed-effect IV estimation. Clustered standard errors at the MFI level were considered. The estimation results are presented in Table 2. Values without parentheses are estimated coefficients, and values in parentheses are standard errors. In addition, although there is no approach to prove the exclusion restriction, we attempted to test the validity of the exclusion restriction of the instrumental variables by estimating the direct effect of the instrumental variables on the outcome variable. [5] The results of this plausibility test are presented in Table A1 in the Appendix, and we confirmed

[5] As discussed by Kippersluis and Rietveld (2018), as long as the instrument variable Z for endogeneity variable X has no direct effect on outcome y, in the sense that $\gamma = 0$ in $y = X\beta + Z\gamma + u$, then the variable Z satisfies the exclusion restriction. Our plausible test in Table A1 in the Appendix has challenges compared to the example showed by Kippersluis and Rietveld (2018), since there are endogeneity variables in the estimation, and it could contaminate the estimation of the coefficient of the instrumental variable. However, our plausible test did not show explicit violation in the exclusion restriction.

that the coefficients of the instrument variables are statistically insignificant. This result supports the assumption of restricted exclusion, namely that the instrumental variable has no direct effect on the effective interest rate.

In the IV estimation, we instrumented the log of loan size per borrower and log of the number of borrowers. We find that the estimated coefficient of the log of loan size per borrower was negative at the 1% statistical significance level, as in the OLS estimation. However, the estimated coefficient of the IV estimation was higher than that of the OLS estimation. The borrowers' demand function is generally downward sloped, and borrowers' marginal utility decreases in the amount of loans. Thus, the results might reflect that the causal effect of loan size per borrower was underestimated in the OLS estimation due to mixing borrowers' factors, and the IV estimation improved the estimation of the pricing function of microfinance loans. The estimated coefficients imply that a 1% increase in the average loan size per borrower leads to a 0.04309% decrease in the effective interest rate. Alternatively, if the loan size increases from 1,000 to 2,000 USD, the effective interest rate decreases by 2.986% on average.[6]

We find that the coefficient of the total number of borrowers is not statistically significant, even in the IV estimation, and its coefficient shows a positive sign. This means that increasing the customer base does not decrease the interest rate of the microloans. The results might reflect that microfinance loans are small in size, and incur a significant fixed cost, such as monitoring and transportation costs, for each loan. Therefore, the scaled-up microfinance business might be unlikely to contribute to a decrease in the interest rate by realizing economies of scale.

For the other variables, the results of the IV estimation are similar to those of the OLS estimation. Regarding the factors relating to costs, we find that labor and funding prices are positively associated with the effective interest rate at the 5% and 1% levels of statistical significance, respectively. The results suggest that an increase in operating costs leads to an increase in the determinants of the interest rate of MFIs, in line with the findings of Dorfleitner et al. (2013) and Cuéllar-Fernández et al. (2016).

Regarding credit risk factors, we find that NPLs are positively associated with effective interest rates at the 1% level of statistical significance. This suggests that an increase in default risk in loan portfolios increases interest rates set by MFIs. In the meantime, the ratio of agricultural loans, the ratio of the number of female borrowers, and the ratio of the number of rural loans are not statistically significant, suggesting that MFIs do not necessarily impose a

[6] This impact is calculated as [log(2000) – log(1000)]×4.309.

premium for female borrowers, rural borrowers, and farmers.

Table 2: Estimation results

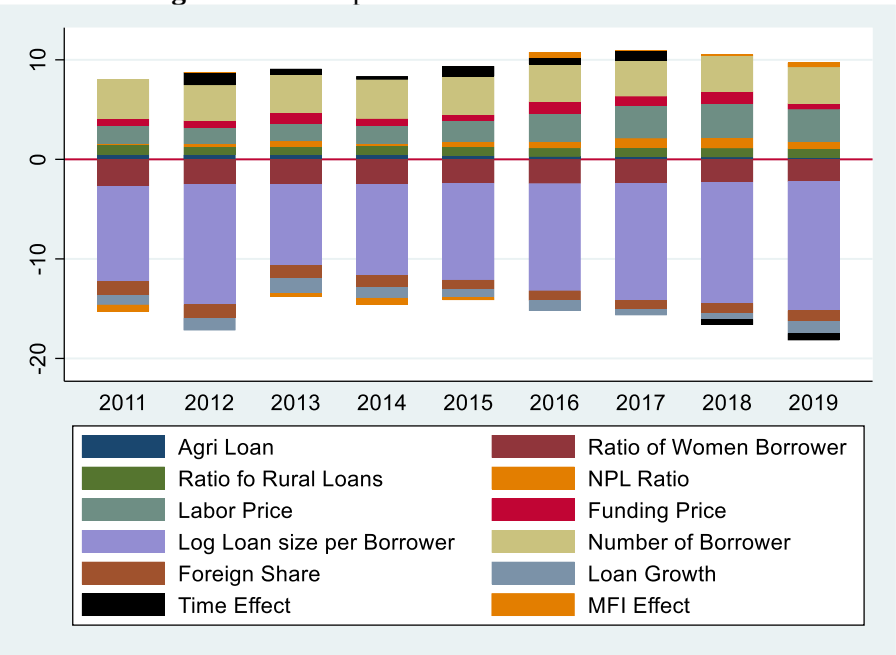
Variable	OLS	IV
Credit Risk Factors		
Ratio of Agricultural Loans	0.019	0.017
	(0.015)	(0.018)
Ratio fo # of Borrowers in Rural Areas	-0.020	-0.033
	(0.026)	(0.029)
Ratio of # of Female Borrowers	0.034	0.012
	(0.022)	(0.046)
NPL Ratio	0.195***	0.185**
	(0.057)	(0.075)
Marginal Cost Factors		
Labor Price	0.057**	0.053**
	(0.022)	(0.022)
Funding Price	0.132***	0.126***
	(0.037)	(0.044)
Log (Average loan size per borrower)	-2.283***	-4.309***
	(0.687)	(0.527)
Log (Total Number of Borrowers)	0.609	0.714
	(0.389)	(1.971)
Other Factors		
Foreign Shares	-3.494	-2.621
	(2.243)	(2.484)
Growth Rate of Loans	-2.993***	-2.439***
	(0.579)	(0.759)
Year 2012 Dummy	1.112	1.212
	(0.812)	(0.830)
Year 2013 Dummy	0.114	0.464
	(0.942)	(0.857)
Year 2014 Dummy	-0.639	0.150
	(0.838)	(1.151)
Year 2015 Dummy	-0.467	0.818
	(0.997)	(1.301)
Year 2016 Dummy	-1.106	0.409
	(1.292)	(1.536)
Year 2017 Dummy	-1.304	0.807
	(1.200)	(1.218)
Year 2018 Dummy	-2.970***	-0.643
	(1.104)	(1.447)
Year 2019 Dummy	-3.705***	-1.023
	(1.090)	(1.500)
MFI-fixed effect	Yes	Yes
Constant	21.073***	25.092*
	(4.489)	(12.864)
R-squared	0.563	0.524
Observations	334	334
Number of MFI	73	73

Note: The table represent the estimation results of fixed-effect IV regression using the NBC Supervisor Annual Report and CMA-NIX (2010-2019) The dependent variable is effective interest rate. Standard errors are reported inside the brackets. Asterisks *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

5.2. Changes in management characteristics of MFIs and their contribution to declining interest rates

The estimation results of Equation (1) allow us to assess the extent to which each variable contributes to the decline in the interest rates of MFIs. Specifically, we calculate the size of each component of Equation 1 ($\hat{\alpha}$, $\hat{\beta}_k\overline{CF}_{k,i,t}, \hat{\gamma}_j\overline{mc}_{j,i,t}, \hat{\psi}_t, \hat{\mu}_i, \hat{\epsilon}_{it}$) for the average MFI in each period. Figure 5 shows the decomposition of the interest rates based on the model estimated in Table 2. We find that an increase in labor prices has been increasingly pushing the interest rate in recent years. Meanwhile, a rise in loan size per borrower seemed to contribute to the recent decline in interest rates. We also find that negative time effects contribute to the reduction in interest rates in 2018 and 2019.

Figure 5: Decomposition of Effective Interest Rate



Next, we investigate how changes in the variables contribute to a decline in interest rates after the interest rate cap policy. The contributions of the changes in MFI characteristics were calculated as $\hat{\beta}_k(CF_{k,2019} - CF_{k,2016})$ and $\hat{\gamma}_k(mc_{k,2019} - mc_{k,2016})$, respectively. The contribution of changes in time effects was calculated as $\hat{\psi}_{2019}$- $\hat{\psi}_{2016}$. Changes in time effects could represent changes in macroeconomic effects and regulations, including the interest rate cap policy, on the market power of MFIs. The negative changes in the time effect suggest a decline in the market power of the MFIs.

From a policy perspective, the effects of the composition of efficient and inefficient MFIs on the market-level average interest rate are also relevant. The MFI-specific fixed effect captures MFI-level efficiency when setting the interest rate. Thus, the difference in the average MFI-specific fixed effects between 2016 and 2019 represents the effect of the existence and entry of inefficient MFIs. The composition effects can be calculated as the mean of $\hat{\mu}_i$ for the MFIs in each year.

Table 3 shows the contributions of the changes in each variable to the decline in the effective interest rate from 2013 to 2016 and from 2016 to 2019. We also illustrate the size of each contribution in Figure 6. Between 2013 and 2016, apart from loan growth, we find that the average MFI fixed effect increases by 0.86. This suggests that inefficient and/or profit-oriented MFIs increasingly entered the Cambodian microfinance market during this period, increasing the average interest rates in the sector.

Between 2016 and 2019, we find that the increases in loan size per borrower and changes in time effects are the largest contributors to the decline in the effective interest rate among all the factors. The result suggests that increasing the loan size was the main strategy to reduce the interest rate after the interest rate cap policy, although Baquero et al. (2018) do not find a significant correlation between loan size and interest rates.

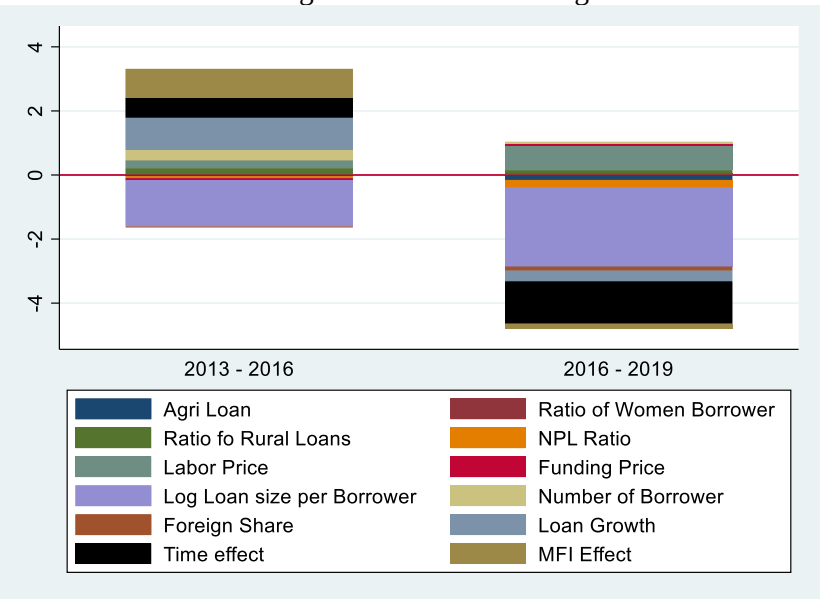
Another major contribution of changes in time effects suggests that MFIs were forced to reduce market power in lending.

Table 3: Changes in variables and contributions to decline in effective interest rates

	2013 - 2016		2016 - 2019	
	Changes in variable	Contribution to decline in IR	Changes in variable	Contribution to decline in IR
Ratio of Agricultural Loans	-2.30	-0.04	-8.28	-0.13
Ratio of # of Female Borrowers	-0.76	0.02	-1.27	0.04
Ratio fo # of Borrowers in Rural Areas	10.45	0.41	5.68	0.23
NPL Ratio	-0.34	-0.06	-1.25	-0.21
Labor Price	4.60	0.27	14.16	0.84
Funding Price	-0.44	-0.06	0.52	0.07
Log (Average loan size per borrower)	0.33	-0.93	0.57	-1.60
Log (Total Number of Borrowers)	0.70	0.17	0.13	0.03
Growth Rate of Loans	-0.40	1.20	0.13	-0.40
Year Effect		-0.56		-2.15
MFI Fixed-Effect		0.86		-0.12

Note: The contributions of changes in MFI characteristics are calculated as $\hat{\beta}_k(CF_{k,2019} - CF_{k,2016})$, and $\hat{\gamma}_k(mc_{k,2019} - mc_{k,2016})$, respectively.

Figure 6: Contributions of changes in variables to changes in effective interest rate



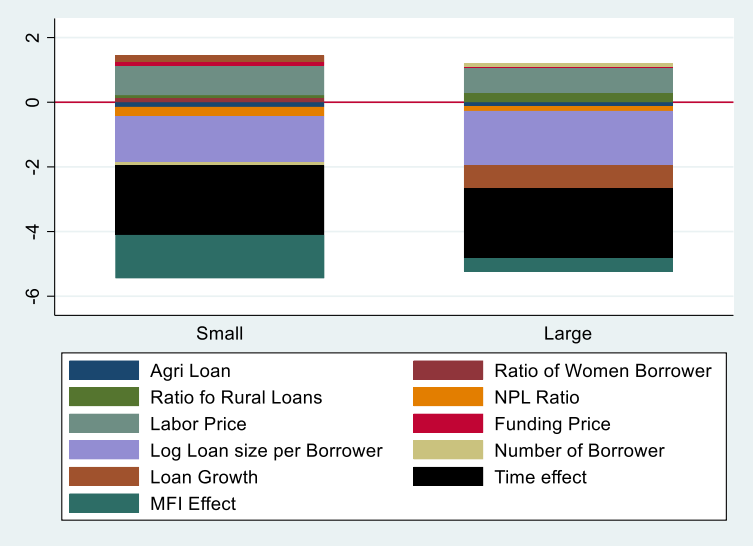
We also calculated the contributions of changes in the variables to the decline in the interest rate for small and large MFIs. We define MFIs as large MFIs if they have assets more than the median values of the distribution of MFIs' asset size in 2019; otherwise, we define the MFIs as small MFIs. We calculated the average changes in the variables for both large and small MFIs. Table 4 shows the average changes in the independent variables between 2016 and 2019. We also calculated the contribution of changes in variables to the changes in the effective interest rate. The size of the contributions is further illustrated in Figure 7.

We find that large MFIs increased the number of borrowers between 2016 and 2019, whereas small MFIs decreased the number of borrowers in the same period. Furthermore, for small MFIs, there are huge contributions from composition effects to the decline in interest rates. This suggests that the reduction in interest rates for small MFIs is largely realized by the exits of inefficient and/or profit-oriented MFIs.

Table 4: Differences in contributions between Large MFIs and Small MFIs

	Small	Large	Difference
Ratio of Agricultural Loans	-0.14	-0.12	-0.02
Ratio of # of Female Borrowers	0.14	-0.01	0.15
Ratio fo Loans in Rural Areas	0.08	0.30	-0.22
NPL Ratio	-0.30	-0.13	-0.17
Labor Price	0.93	0.77	0.15
Funding Price	0.10	0.03	0.07
Log (Average loan size per borrower)	-1.41	-1.69	0.29
Log (Total Number of Borrowers)	-0.10	0.10	-0.20
Growth Rate of Loans	0.20	-0.71	0.91
Year Effect	-2.72	-2.72	0.00
MFI Fixed-Effect	-1.34	-0.41	-0.93

Figure 7: Differences in contributions between Large MFIs and Small MFIs



Note: The figure shows how much changes in independent variables affected changes in interest rate after the interest rate cap policy (between 2016 and 2019). We define the MFIs as a large MFI if it has assets more than the median value of the distribution of MFIs' asset size in 2019, and otherwise we define the MFI as a small MFI. We calculated average changes in the variables for both large MFIs and small MFIs.

.

6. Concluding remarks

In this study, we investigate the determinants of interest rates of MFIs by focusing on the case of a newly introduced interest rate cap policy in Cambodia. This policy forced MFIs to reduce interest rates to a great extent, so that the analysis of MFIs' behavior before and after the policy allows us to study which factors significantly affect interest rates.

Our results suggest that increasing the number of borrowers does not lead to a decrease in marginal costs, while increasing loan sizes per borrower contributes to a decrease in interest rate. This might reflect that lending to poor and distant borrowers causes large costs such as monitoring and transportation costs, implying that scaling up microfinance lending per se does not realize economies of scale. In the meantime, MFIs can realize economies of scale by increasing the loan size per borrower due to the large fixed cost per loan. Thus, as a result of the interest rate cap policy, Cambodian MFIs increased loan size per borrower to reduce marginal costs and then to reduce interest rates.

We also find that NPL ratios are positively correlated with the effective interest rate. This suggests that default risks in the loan portfolio are significant cost factors, and the risks are passed on to borrowers. This finding has important policy implications during the COVID-19 pandemic. Economic shocks during the pandemic increased the default risk of MFI borrowers. Thus, there is a possibility that the increase in default risk forces MFIs to further increase loan sizes per borrower to maintain their policy of providing loans to poor borrowers.

We believe that the findings of our study provide new insights from both policy-making and academic perspectives. However, there were some caveats in the interpretation of our analysis. First, although we find that MFIs kept lending to rural borrowers, female borrowers, and farmers after the interest rate cap policy, our results still cannot rule out the possibility that the mission drift of MFIs occurred after the policy. Since the data of CMA-NIX are limited to district-level variation, the data do not allow us to detect the shift in the MFI policy from poorer to richer borrowers within a district. Second, from a theoretical perspective, exchange rate risks are also seen as a factor that drives MFIs to increase interest rates. However, there is no comprehensive data on the balance sheets of MFIs in currency terms. Thus, our model might still be subject to omitted variable biases, although most MFIs tend to avoid currency risk by lending in dollars (USD). Although these drawbacks do not necessarily affect our conclusion, detailed data are required to address these issues.

Appendix A

Table A1: Results of the validity of exclusion restriction test of instrument variables

Variable	OLS
Weighted Population Sizes	-0.000
	(0.000)
Weighted Road Lengths	0.005
	(0.004)
Credit Risk Factors	
Ratio of Agricultural Loans	0.017
	(0.014)
Ratio fo # of Borrowers in Rural Areas	0.037
	(0.023)
Ratio of # of Female Borrowers	-0.014
	(0.026)
NPL Ratio	0.201***
	(0.059)
Marginal Cost Factors	
Labor Price	0.059***
	(0.022)
Funding Price	0.132***
	(0.037)
Log (Average loan size per borrower)	-1.938**
	(0.834)
Log (Total Number of Borrowers)	0.752*
	(0.428)
Other Factors	-3.431
Foreign Shares	(2.196)
	-3.123***
Growth Rate of Loans	(0.551)
	1.271
Year 2012 Dummy	(0.822)
	0.059
Year 2013 Dummy	(0.929)
	-0.655
Year 2014 Dummy	(0.810)
	-0.416
Year 2015 Dummy	(0.931)
	-1.435
Year 2016 Dummy	(1.350)
	-1.665
Year 2017 Dummy	(1.187)
	-3.479***
Year 2018 Dummy	(1.177)
	-4.120***
Year 2019 Dummy	-3.705***
	(1.090)
MFI-fixed effect	Yes
Constant	20.238***
	(4.596)
R-squared	0.563
Observations	334
Number of MFI	73

References

Aiba, D. and Lam, R., 2019. "Is Dollarization a Problem in the Cambodian." *Asian Studies (Aziya Kenkyu)* **65**, pp. 45-60.

Aiba, D., Samreth, S., Oeur, S. and Vat, V., 2021. "Impact of Interest Rate Cap Policies on the Lending Behavior of Microfinance Institutions: Evidence from Millions of Observations in the Credit Registry Database," JICA Ogata Research Institute Working Paper No. 224.

Al-Azzam, M. and Mimouni. K., 2017. "Currency Risk and Microcredit Interest Rates," *Emerging Markets Review* **31** (June), pp. 80-95.

Armendariz, B. and Morduch, J., 2005. *The Economics of Microfinance*, MIT Press.

Baquero, G., Hamadi, M. and Heinen, A., 2018. "Competition, Loan Rates, and Information Dispersion in Nonprofit and For-Profit Microcredit Markets," *Journal of Money, Credit and Banking* **50**, pp. 893-937.

Barry, A. and Tacneng, R., 2014. "The Impact of Governance and Institutional Quality on MFI Outreach and Financial Performance in Sub-Saharan Africa," *World Development* **58**, pp. 1-20.

Bauchet, J., and Morduch, J., 2013. "Selective Knowledge: Reporting Biases in Microfinance Data" In Haase, David (Ed) *The Credibility of Microcredit*, pp. 52-82, Brill.

Brickell, K., Picchioni, F., Natarajan, N., Guermond, V., Parsons, L., Zanello, G., and Bateman, M., 2020. "Compounding Crises of Social Reproduction: Microfinance, Over-Indebtedness and the COVID-19 Pandemic," *World Development* **136**, 105087.

Cuéllar-Fernández, B., Fuertes-Callén, Y., Serrano-Cinca, C. and Gutiérrez-Nieto, B., 2016. "Determinants of Margin in Microfinance Institutions," *Applied Economics* **48**, pp. 300-311.

Cull, R., Demirgüç-Kunt, A. and Morduch, J., 2007. "Financial Performance and Outreach: A Global Analysis of Leading Microbanks," *Economic Journal* **117**, F107-33.

Cull, R., Demirgüç-Kunt, A. and Morduch, J., 2018. "The Microfinance Business Model: Enduring Subsidy and Modest Profit," *World Bank Economic Review* **32**, pp. 221-44.

D'Espallier, B., Guérin, I. and Mersland, R., 2011. "Women and Repayment in Microfinance: A Global Analysis," *World Development* **39**, pp. 758-772.

D'Espallier, B., Guérin, I. and Mersland, R., 2013. "Focus on Women in Microfinance Institutions," *Journal of Development Studies* **49**, pp. 589-608.

Dorfleitner, G., Leidl, M., Priberny, C. and von Mosch, J., 2013. "What Determines Microcredit Interest Rates?" *Applied Financial Economics* **23**, pp. 1579-1597.

Entrop, O., Memmel, C., Ruprecht, B. and Wilkens, M., 2015. "Determinants of Bank Interest Margins: Impact of Maturity Transformation," *Journal of Banking and Finance* **54**, pp. 1-19.

Gambacorta, L., 2008. "How Do Banks Set Interest Rates?" *European Economic Review* **52**, pp. 792-819.

Hartarska, V., Shen, X. and Mersland, R., 2013. "Scale Economies and Input Price Elasticities in Microfinance Institutions," *Journal of Banking and Finance* **37**, pp. 118-131.

Hermes, N., Lensink, R. and Meesters, A., 2011. "Outreach and Efficiency of Microfinance Institutions," *World Development* **39**, pp. 938-48.

Hossain, S., Galbreath, J., Hasan, M. and Randøy, T., 2020. "Does Competition Enhance the Double-Bottom-Line Performance of Microfinance Institutions?" *Journal of Banking and Finance* **113**, 105765.

Hudon, M., and Traca, D., 2011. "On the Efficiency Effects of Subsidies in Microfinance: An Empirical Inquiry," *World Development* **39**, pp. 966-973.

International Monetary Fund. Asia and Pacific Dept (IMF) (2017) "Front Matter," *IMF Staff Country Reports* 2017, 325.

Kippersluis, H., and Rietveld, C., 2018. "Beyond Plausibly Exogenous," *Econometrics Journal* **21**, pp. 316-331.

Maimbo, S., and Gallegos, C., 2014. "Interest Rate Caps around the World: Still Popular, but a Blunt Instrument," World Bank Policy Research Working Paper No. 7070, the World Bank.

Maudos, J., and Guevara, J., 2004. "Factors Explaining the Interest Margin in the Banking Sectors of the European Union," *Journal of Banking and Finance* **28**, pp. 2259-2281.

McIntosh, C. and Wydick, B., 2005. "Competition and Microfinance," *Journal of Development Economics* **78**, pp. 271-298.

National Bank of Cambodia (NBC). (2017, 2018) *Annual Supervision Report.* National Bank of Cambodia, Phnom Penh, Cambodia.

Quayes, S., 2021. "An Analysis of the Mission Drift in Microfinance," *Applied Economics Letters* **28**, pp. 1310-16.

Roberts, P., 2013. "The Profit Orientation of Microfinance Institutions and Effective Interest Rates." *World Development* **41**, pp. 120-31.

Rosenberg, R., 2002. "Microcredit Interest Rates," CGAP Occasional Paper No. 1, Consultative Group to Assist the Poor.

Samreth, S., Aiba, D., Oeur, S. and Vat, V., 2021. "Impacts of the Interest Rate Ceiling on Microfinance Sector in Cambodia: Evidence from a Household Survey," JICA Ogata Research Institute Working Paper No. 219.

Saunders, A., and Schumacher, S., 2000. "The Determinants of Bank Interest Rate Margins: An International Study," *Journal of International Money and Finance* **19**, pp. 813-32.

Schreiner, M., 2002. "Aspects of Outreach: A Framework for Discussion of the Social Benefits of Microfinance," *Journal of International Development* **14**, pp. 591-603.

Stiglitz, J. and Weiss, J., 1981. "Credit Rationing in Markets with Imperfect Information," *American Economic Review* **71**, pp. 393-410.

Tchakoute-Tchuigoua, H., 2012. "Active Risk Management and Loan Contract Terms: Evidence from Rated Microfinance Institutions," *Quarterly Review of Economics and Finance* **52**, pp. 427-437.