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Study on the Promotion of Financial Inclusion: The Case of Cambodia

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Impact of Interest Rate Cap Policies on the Lending Behavior of Microfinance Institutions: Evidence from Millions of Observations in the Credit Registry Database

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Abstract

In April 2017, the Cambodian central bank introduced an interest rate cap (IR cap) policy relating to lending by microfinance institutions (MFIs). There was no restriction on lending rates before the policy implementation and many of the MFIs was lending at a rate of more than 18%. Thus, there was some concern about the negative effects the IR cap policy may have on outreach efforts by MFIs. This paper explores the impact of the IR cap on MFIs, by accessing granular data from the credit registry database in Cambodia. We use 6,897,168 individual loans from all regulated financial institutions, including commercial banks, specialized banks, and microfinance institutions in the period from January 2016 to March 2019. We find that both the average size per loan and the probability of requiring collateral increased after the IR cap policy was introduced for MFIs, as small-sized loans and non-collateral loans are typically costly for microfinance institutions to extend. In addition, we found that the borrowers of small-sized loans before the IR cap were likely to be excluded from the formal financial market after the IR cap. Those findings suggest that the IR cap did have an impact on the outreach of financial systems.

Keywords: Interest Rate Cap, Microfinance, Cambodia, Regulation, Bank Lending

JEL Classification: G21; G38; O16

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1. Introduction

Microfinance institutions (MFIs) play an important role in achieving outreach of the financial system to the poor in developing countries. However, high interest rates set by MFIs have often been viewed as a problem. In many countries, the microfinance sector has frequently experienced problems with over-indebtedness, and there has been criticism of predatory lending by profit-oriented lenders (Brickell et al. 2020). In order to reduce the debt burden for borrowers and to prevent unfairly high interest rate, governments commonly rely on interest rate cap (IR cap) policies (sometimes referred to as interest rate ceilings or usury laws) in both developing and developed countries (Maimbo and Gallegos 2014). However, the implementation of the policy may have positive and negative effects on financial inclusion, and there is particular concern about the negative consequences for MFIs. The objective function of MFIs may be different to that of traditional banks, as MFIs aim to increase their outreach to the poor. To achieve this outreach objective, MFIs might engage in cross-subsidization between clients whereby the reduction in profit from overall lending will reduce lending to poor households (McIntosh and Wydick 2005). Previous studies found that the introduction of an IR cap policy leads to a reduction in loan supply (Helms and Rellie 2004; Madeira 2019), and further causes a rise in market interest rates for borrowers due to a rise in the number of informal lenders (Mamibo and Gallogos 2014).

MFIs in Cambodia are regulated and supervised by the National Bank of Cambodia (NBC), Cambodia's central bank.[1] In April 2017, the NBC implemented an IR cap policy on the microfinance sector. The IR cap policy restricted interest rates on lending to no more than 18% per annum (1.5% monthly for all MFIs and credit operators.) The policy was aimed at improving the operational efficiency of MFIs and reducing the debt burden on consumers with over-

[1] In Cambodia, microfinance institutions are categorized into two legal entities: deposit-taking microfinance institutions (MDIs) and non-deposit taking microfinance institutions (non-MDIs). The former are legally known as MDIs, and the latter are MFIs in the official documents of the NBC. However, throughout this paper, we label non-deposit taking microfinance institutions as "non-MDIs" to avoid confusion; we label MDIs and non-MDIs collectively as MFIs.

indebtedness issues (NBC 2018; IMF 2017). However, before the IR cap policy came into effect, a number of MFIs extended loans at an interest rate of more than 18%, particularly for customers whose credit risks were high; most of these loans were given to the poor. Thus, there is some concern that the new policy curbed MFI lending in Cambodia, particularly for those MFIs with a focus on the poorest clients in remote regions. The resulting problem is that such clients may lose access to formal financial institutions and may instead seek to borrow money from informal money lenders at less transparent rates. Importantly, even though Cambodian MFIs are regulated, the requirements for entering the microfinance market in Cambodia are low, and the number of MFIs has been increasing in recent years. The high intensity of competitiveness in the Cambodian microfinance sector could drive MFIs to reduce loans to the poor in response to the introduction of an IR cap policy. Therefore, even though the IR cap policy could be an effective way of enhancing the efficiency of MFI operations and reducing debt burdens, the policy may also have a negative impact on financial inclusion.

In this study, we attempt to address how an IR cap policy affects financial inclusion by examining the effects of the newly introduced IR cap policy on the lending behavior of MFIs in Cambodia. We use the database of the Credit Bureau of Cambodia (CBC) as this provides us with information on the disbursements of all individual loan and group loan accounts. Our data spans the period from 2016M1 to 2019M3 on a monthly basis and covers approximately 6,897,168 individual loan disbursements across all regulated financial institutions. During the period of our analysis, the data covers 42 commercial banks, 14 specialized banks, 7 microfinance deposit-taking institutions (MDIs), and 80 microfinance non-deposit taking institutions (non-MDIs). The detailed loan-level data allowed us to investigate the impact of policy implementation by loan conditions and by financial institutions. For the identification of the impact of the IR cap policy, we use small-sized loans from commercial banks and specialized banks as a control group. The IR cap policy was only applied to MFIs, although some commercial banks also extend loans to households for agricultural purposes, for running micro, small and medium-sized enterprises, and

for poverty reduction purposes.[2] We exploit this natural experiment design to identify the effect of the IR cap policy on MFI lending by applying the Difference-in-Difference (DID) estimation. Furthermore, we also examine which borrowers were excluded from the formal financial market after the IR cap policy. Based on the borrower's IDs in the data, we identify who borrowed from MFIs before the IR cap policy, and examine which borrowers retained access to formal financial institutions after the IR cap policy.

We find that both average loan size and the probability of requiring collateral increased after the IR cap policy was introduced for MFIs. Small-sized loans and non-collateral loans are typically costly for microfinance institutions to extend. The results suggest that MFIs decreased the provision of costly loans. In addition, we found that borrowers of small-sized loans and group-lending and non-collateral loans before the IR cap were likely to be excluded from the formal financial market after the IR cap. Those findings suggest that the IR cap has an impact on the outreach of the financial system.

Looking at gender, we did not find that the IR cap policy *per se* affected the lending behavior of female borrowers. However, female-related loans tend to be small and non-collateral loans, which are cost factors in MFI lending and are also impacted by IR cap policies.[3] While MDIs and non-MDIs did not decrease their loan provisions simply because borrowers were female, loans for female borrowers could also be negatively affected by the interest rate cap policy.

We further documented evidence that the IR cap policy indirectly affected the interest rates of commercial bank loans. This impact was possibly channeled through the strong competition between the MFIs and the commercial banks. There is some overlap in the customer segments of commercial banks and those of MFIs. As a result, in situations where MDIs and non-MDIs decrease their interest rates, commercial banks may face pressure to respond by also decreasing their rates in order to keep their customers. However, our analysis suggests that, at

[2] For example, Acleda Bank, Sathapna Bank, and Cambodia Post Bank have many branches all over Cambodia. A large percentage of customers are households in rural areas.
[3] In this paper, female-related loans refer to loan accounts which involve at least one female borrower.

least in the short term, the IR cap did not produce any clear spillover effects on the loan conditions of commercial banks. These findings support the validity of the identification strategy we used in our analysis.

Our study provides new evidence related to the literature on the impact of regulation on financial inclusion, with a particular focus on MFI lending. Several studies have investigated the impact of IR cap policies in the context of developing countries and MFIs. Helms and Rellie (2004) found that the introduction of an IR cap policy leads to a reduction in loan supply. In the case of Bolivia, where there are government implemented credit quotas and IR caps on targeted sectors, Heng (2015) analysised aggregated data and showed that credit to targeted sectors grew; however, this growth was due to an increase in average loan sizes, while the number of borrowers decreased. Studies that use microdata from loan accounts and investigate causal inference are scarce. Since microfinance sectors are less likely to be strictly regulated and microfinance loans are typically extended by small NGOs, data from the microfinance sectors of developing countries is not generally available, and previous studies have struggled to identify the impact of the IR cap policy. In this regard, our study provides clear evidence using unique credit registry data, which comprehensively covers the individual loan disbursements of all the microfinance institutions and the traditional commercial banks in Cambodia.

In addition, we extend the empirical method to identify the causal impact of the IR cap. Due to data limitations, studies on causal inference in the estimation of the impact of the IR cap are scarce. In the context of the traditional banking sector in developing countries, Madeira (2019) used the Chilean household and credit registry data to document the empirical evidence that households which had loans with interest rates higher than cap were less likely to keep borrowing after the IR cap. In developed countries, Cozarenco and Szafarz (2020) employed DID estimation to 1,016 loan applications made to a French MFI in order to identify the impact of an IR cap. Fekerazad (2020) investigated the effects of the IR cap on the payday loan market in the US using state-month-level panel data and a DID framework. He found that the IR cap increased the number

of loans and the principal per loan, but did not affect the default rates. Additionally, using data from the online lending marketplace in the US, Rigbi (2013) found that the IR cap had a negative impact on the payday loan markets for firms and consumers. However, their study mainly focused on traditional banks or MFIs in developed countries. In contrast to the above-mentioned studies, we investigated how the IR cap affected MFIs, using the granular and comprehensive data from the loan accounts of all financial institutions in Cambodia. Thus, our study is the first to provide empirical evidence on the impact of the IR cap on MFIs in developing countries using granular data at the loan level. Compared to commercial banks, regulation of MFI lending widely varies across countries. Thus, studying the impact that the implementation of an IR cap policy may have on MFIs may provide useful insights for other developing countries that are considering the introduction of similar regulations.

Lastly, our study considers the heterogeneous effects in the impact of the IR cap policy. Theoretically, as one of the factors, the impact of the IR cap may also depend on the competitiveness of the market. If an MFI exercises market power and sets interest rates higher than the market rate, the IR cap policy would increase both the loan provision and the efficiency of the market. If the market is competitive, the IR cap policy would decrease the loans and also reduce efficiency. However, there is a paucity of studies focusing on the effects of an IR cap on market competitiveness. We therefore constructed a Herfindahl-Hirschman Index (HHI) to proximate market competitiveness in MFI loans. As a result, we found that the impacts of the IR cap were not necessarily dependent on competitiveness.

The rest of the paper is structured as follows: Section 2 provides a review of the literature on interest rate cap policies in developing and developed countries. Section 3 presents the institutional background of the Cambodian microfinance sector and the implementation of the interest rate cap policy. Section 4 describes the data used in our empirical analysis and sets out the descriptive statistics. Section 5 presents the empirical analysis of the impact of the IR cap on MFI lending and section 6 presents the analysis of the impact of the IR cap on borrowers access

to finance. Section 7 discusses the spillover effect of the IR cap into commercial banks, and Section 8 concludes.

2. Literature on Interest Rate Cap Policies

An IR cap policy (sometimes also referred to as an interest rate ceiling or usury laws) is a common measure across developing and developed countries (Mamibo and Gallogos 2014). The policy is primarily implemented for consumer protection to prevent high borrowing costs, over-indebtedness, and predatory lending by financial institutions; it is rarely used for financial inclusion. The IR cap policy has attracted interest from politicians because it can be used to protect established interest groups (Benmelech and Moskowitz 2010) and to benefit borrowers by reducing debt burdens (Safavian and Zia 2016).

Theoretically, the effects of lowering interest rates using an IR cap policy could vary depending on several factors such as the extent of market competition, the level of the interest rate cap, and the business models of financial institutions. In terms of business models, MFIs are different from traditional financial institutions, such as commercial banks, that aim to maximize profit from their lending operations. MFIs were originally established as a way to extend financial services to the poor under favorable conditions. In contrast to traditional banks, MFIs are aimed at serving the number of borrowers who are generally deemed un-bankable by commercial banks. In the literature, there is a paucity of studies on the effects of IR cap policies on MFI behavior given that MFIs have the objective to increase their outreach while they have to keep their sustainability at the same time.

Generally traditional financial institutions set interest rates based on the following factors: (1) cost structures, such as funding costs and operational costs; and (2) the characteristics of their loan portfolios. Credit risk and maturity structures also affect the optimal interest rate for financial institutions (Entrop et al. 2015). Additionally, like other ordinary industries, market conditions

also matter to the banking sector. The market power of financial institutions (i.e., competitiveness) determines how much profit financial institutions make by setting high interest rates (Saunders et al. 2000; Maudos et al. 2004; Gambacorta 2008). Furthermore, Saunders et al. (2000) empirically found that apart from credit risks, the intensity of regulations on financial institutions also affects interest rates. In the meantime, outreach-oriented MFIs may cross-subsidize clients to extend loans to the poor at lower interest rates. McInctosh and Wydick (2005) developed a theoretical model to explain cross-subsidization in MFI lending. According to his model, competition with profit-oriented financial institutions would also reduce the provision of loans to the poor by reducing profits from non-risky borrowers. Financial institutions need to sustain their business by maintaining non-negative profits; however, lending to the poor is costly due to the high risk of defaults and the physical cost of a visit to customers in distant areas, and those high cost factors make it difficult to increase outreach to the poor. In the case of cross-subsidization, an IR cap policy could negatively affect the cross-subsidization activities of MFIs, by reducing the profit of MFIs through the curbing of their market power. As a result, MFIs would then reduce the provision of loans to the poor as the budget for serving the poor decreases.

Although the use of IR cap policies is common practice in many countries, a strand of the literature presents mixed results on the real effects of this policy on financial institutions and the accumulation of evidence is insufficient. Alessie et al. (2005) found that the policy had a positive impact on credit supply in Italian consumer markets. Fekerazad (2020) investigated the impacts of IR caps on the payday loan market in the US using state-month-level panel data and a DID framework. He found that the IR cap increased the number of loans and the principal per loan, but did not affect the default rates. In the meantime, using data from the online lending marketplace in the US, Rigbi (2013) estimated the effects of changes in usury laws that increased the maximum interest rate charged to borrowers to 36%. His data showed that the increase in the IR cap was correlated with an increase in the probability of being funded. This was especially true

in relation to borrowers who had not received funds previously, suggesting that potential borrowers were excluded from the loan market under the previous low IR cap policy.

In recent decades, the use of an IR cap policy has become common in developing countries. Below, we review the recent studies on IR cap policies in developing countries, a summary of which is set out in Table 1. First, the studies reveal that poor, rural clients may lose access to formal financial institutions, and instead seek to borrow money from informal money lenders with less transparent rates. Helms and Rellie (2004) used aggregated country panel data from MFIs in 40 developing countries and found that the introduction of an IR cap policy led to a reduction in loan supply at statistical significance. In the case of Bolivia, Heng (2015) conducted an analysis of the impact of an IR cap using aggregated MFI loan data. The study showed that although credit to targeted sectors grew, this growth was due to an increase in average loan sizes, while the number of borrowers actually decreased.

Table 1: Recent Studies on Interest Rate Cap Policies in Selected Developing Countries

After the implementation of an IR cap, financial institutions in several countries have tended to charge higher fees while reducing interest ratesat the same time. This increase in transparency has negatively affected borrowers' understanding of real interest rates. Some studies have found that the IR cap policy may also cause a rise in interest rates because of an increase in informal lenders, and additional fees and commissions. In the cases of Armenia, Nicaragua, and South Africa, a lack of transparency in how to calculate the effective interest rate led banks and MFIs to charge additional fees and commissions (Mamibo and Gallogos 2014). The Bank of Zambia took action to address this issue by removing all caps and issued a new circular for financial institutions to disclose their fee charges (Ferrari et al. 2018).

However, prior studies on IR cap policies generally lack rigorous analysis using micro data in developing countries. Madeira (2019), for example, used household panel data and

employed the regression discontinuity design to estimate the impact of the IR cap in Chile. The detailed data allowed them to draw a valid causal conclusion that households where interest rates for loans were above the IR cap were less likely to continue borrowing after the IR cap was increased.

Rigorous analysis of the impact of IR caps on MFIs is also scarce. Using data from 1,016 loan applications to a French MFI, Cozarenco and Szafarz (2020) investigated the impact of the IR cap on MFI lending. However, their study is in the context of MFIs in developed countries. In addition, since the sample size of the data is also small and from a single MFI, there is an issue around the representativeness of the sample for the real population of MFIs and their borrowers.

Theoretically, the impact of the regulation suggests that an IR cap policy may depend on the competitiveness of loan markets and current regulatory conditions. To the best of our knowledge, prior studies have not empirically investigated the relationship between competition and IR cap policies in MFIs. By estimating the competitiveness of MFIs, Baquero et al. (2018) found that the interest rates of MFIs are significantly affected by competition. Their study suggests that the effect of an IR cap policy on MFIs may also depend on the extent of competition.

3. The Interest Rate Cap Policy in Cambodia

The Cambodian banking sector is regulated by the National Bank of Cambodia (NBC). According to the NBC (2018), as of 2017, the Cambodian banking sector was composed of five types of financial institutions, namely: 39 commercial banks, 15 specialized banks, 76 microfinance institutions (MFIs), 313 rural credit institutions, and 11 financial lease companies.[4] The MFIs are further divided into 7 deposit-taking microfinance institutions (MDIs), and 69 non-deposit-taking microfinance institutions (Non-MDIs). Regulations on MDIs and non-MDIs, such as minimum

[4] There are also 11 foreign bank representative offices, and 1 credit bureau company in Cambodia. Those institutions are not engaged in banking activities in Cambodia but are required to report their activities to the NBC.

capital requirement, solvency ratios, and liquidity ratios, are different. The minimum capital requirement is USD 30 million for MDIs, and USD 1.5 million for non-MDIs. The minimum solvency ratio for MDIs is 15%, and minimum liquidity ratio for MDIs is 70%. MDIs are further required to adhere to the reserve requirement ratio of 8%. Generally, rural credit institutions are small NGOs that operate in rural areas and receive loans from MDIs or non-MDIs to provide credit to rural households.

On 3 March 2017, an IR cap policy was announced; the policy has been implemented since 1 April 2017 (NBC 2018). According to NBC (2017, 2018), the policy requires MDIs, non-MDIs, and rural credit institutions under the NBC's supervision to set loan interest rates at a maximum of 18% per year for any maturity. This interest rate ceiling applies to new credit contracts as well as restructured loans and refinancing since 1 April 2017. The interest rate cap policy initially aimed to improve market efficiency by dumping inefficient MFIs from the market (IMF 2017). As of 2019, no MFIs had withdrawn from the market due to the IR cap, but several MDIs and non-MDIs had been acquired or merged with other financial institutions and/or non-financial institutions.

The government may have also expected that the introduction of an IR cap policy would reduce household debt burdens (IMF 2017; NBC 2018). In fact, there were concerns about over-indebtedness from predatory lending in the MFI sector. The average amount of loans has been increasing rapidly, while the rise in SME loans and mortgage loans has contributed to increasing loan sizes. Although an IR cap can reduce the debt burden for such highly indebted households, the cap introduced in Cambodia was too low for MFIs to be able to keep lending to the poor. Before the interest rate cap policy was implemented, the estimated average interest rates were more than 20%; however, MFIs that lent to rural households had set average interest rates at higher than 30% (Aiba et al. 2020).

To reduce the operational burden of the IR cap, the NBC issued a circular titled "Terms and Conditions for Banks and Financial Institutions Applying for Securities Registration in

Cambodia Securities Exchange" on 27 September 2017. The circular aimed to empower institutions to mobilize and raise funds to contribute to Cambodia's economic development. Furthermore, on 27 October 2017, the Ministry of Economy and Finance issued a circular on "Withholding Tax on Interest for Non- residents to MFI", which aimed to help ease the MFIs' funding costs from overseas, boost the sustainability of the microfinance sector, and provide partial preferential treatment around the withholding tax on the interest on MFI foreign loans. Under a withholding tax of 14%, MFIs must impose a tax deduction of 10% from the interest paid to non-resident taxpayers. The remaining 4% of the withholding tax is deemed to be the responsibility of the government as a means of support the microfinance sector.

Since the policy is only applied to interest payments for loans, there may be loopholes that allow MFIs to circumvent the restrictions. For example, microfinance institutions may start to charge or increase their regular fees to cover loan administration costs, as the restriction only caps nominal interest rates. In fact, after the IR cap policy was introduced, nominal interest rates and effective interest rates started to decouple.[5] Figure 3 shows the levels of average nominal interest rates and effective interest rates of MFIs. We collected this data from the NBC Annual Supervision Reports, and calculated nominal interest rates and effective interest rates for each of the MFIs in the reports.[6]

Figure 1 shows that in 2016, the average interest rates were higher than 18% for half of the MFIs, while most of them lowered their average interest rates to below 18% in 2018. In 2016, there was no significant difference between nominal interest rates and effective interest rates, suggesting that prior to the implementation of the IR cap policy, MFIs made revenue mainly through interest payments. However, in 2018, nominal interest rates and effective interest rates

[5] Here, nominal interest rates are defined as income from interest divided by the amount of loans. Effective interest rates are defined as the sum of interest and non-interest incomes divided by the amount of loans.

[6] Although the average interest rate measures are easy to obtain from public open data sources, there are a number of caveats to their interpretation. If loan amounts increase in a year, this measure would under-estimate the actual interest rate. On the other hand, if loans decrease in a year, this measure would overestimate the actual interest rate.

started decoupling for most non-MDIs. Even after the implementation of the IR cap policy, some non-MDIs kept effective interest rates at the same level by increasing non-interest income. The results suggest that non-MDIs seem to attempt to offset the impact of IR cap policies by increasing fee charges on loans. There is much anecdotal evidence suggesting such a practice exists.

However, effective interest rates have on average declined after the IR cap policy was introduced. Figure 2 shows the time trend of the median of nominal interest rates and effective interest rates. The data used here is a balanced panel. We dropped the MFIs which do not continuously exist in the data from 2014 to 2019. The median of both interest rate and effective interest rates continuously decreased after the policy change. Thus, even though there may be loopholes for MFIs, it is still likely that this policy change would affect MFI lending behavior. The decline in effective interest rates may also be due to NBC's announcement it would be conducting on-site audits of the fees charged to ensure the fees are not "unfairly" high (NBC 2018).

Figure 1: Average Interest Rates and Average Effective Interest Rates Before and After the Policy Introduction

Figure 2: Dynamics of Interest Rates and Effective Interest Rates Before and After the Policy Introduction

4. Data Description

We use account-level data from loan disbursements to carry out an empirical investigation into changes in the number of loan disbursements and the size of loan disbursements per account. The data were extracted from the credit registry database of the Credit Bureau Cambodia (CBC), and cover a total of 6,897,168 loan disbursements from 2016M1 to 2019M3. The data cover all the

disbursements of individual loans from commercial banks, specialized banks, MDIs, and non-MDIs. Since some borrowers have multiple loans, borrow repeatedly for different purposes, or refinanced loans during the period from 2016M1 to 2019M3, the number of unique borrowers in our data is 4,189,369.

There is one caveat on the analysis of these data. Although individual loans for business purposes are included, our data does not cover corporate loans. Thus, there is a concern that our analysis might overlook the important aspects of MFI lending, namely that in recent years MDIs and non-MDIs have increased their role in the financial inclusion of SMEs and increased the portion of corporate loans in their portfolios. However, in reality, corporate loans by MDIs and non-MDIs are still trivial in Cambodia. Table 2 shows the ratio of corporate loans to total aggregated loans for MFIs and commercial/specialized banks as of December 2019. Even though MDIs and non-MDIs have recently increased corporate loans, the share of corporate loans is still small both in terms of the balance and number of loan accounts. Therefore, our data captures almost the entire lending behavior of non-MDIs and MDIs.

Table 2: The Share of Commercial Loans to Total Outstanding Loans in CBC data as of December 2019

First, using CBC's data, we describe the characteristics of the Cambodian microfinance sector. In Figure 3, we present the composition of newly disbursed loans across non-MDIs and MDIs by urban and rural areas, by product type, and by loan size as of 2016. Demand for loans and the risk profiles of customers varies across locations. For example, the occupations and living standards of households are similar within regions. Considering that technology used by MDIs and non-MDIs to screen customers is limited, the locations where customers live is crucial information for lending by MDIs and non-MDIs. In Figure 3, the color of the bars shows the head accounts of disbursed loans in each category as percentages of the total number of newly

disbursed loans in 2016. This shows that there is a wide variation in the operations of non-MDIs and MDIs in terms of their geographical locations, product types, and loan sizes. Specifically, some of the non-MDIs and MDIs only focused on urban or rural areas. There is also a wide variation in the portfolio of loan products across MFIs. For some non-MDIs, mortgage loans represent a large share of their loan portfolios; others concentrate on agricultural and community loans. There are also significant differences in loan sizes among non-MDIs and MDIs. Some non-MDIs and MDIs have a large share of loans of less than USD 500 in their loan disbursements, while others have a large share of loans of more than USD 10,000.

Figure 3: Comparison of Loan Portfolios Across Non-MDIs and MDIs

These results suggest that lending behavior and customer bases could differ from institution to institution. In other words, MDIs and non-MDIs differentiate loan products in terms of loan and borrower characteristics, such as locations, product types, and loan sizes. In general, the proportion of fixed costs to loan size is smaller for larger sized loans. Thus, the interest rates on loans generally decrease in line with the size of the loans. Additionally, since the sensitivity of consumer demand to interest rates differs among product types and loan purposes, the impact of interest rates may vary across non-MDIs and MDIs with different business models.

In Table 3 we present the descriptive statistics of several loan characteristics by MDIs and non-MDIs. These loan characteristics are different across product types rather than types of financial institutions. The average amounts of loan disbursements are higher for MDIs than they are for non-MDIs within each loan product type. Moreover, there are huge variations across loan products for both MDIs and non-MDIs. The average loan sizes are smallest for community loans, which are products relating to group lending or village banking. The loan sizes are highest for mortgage loans, which are generally extended for the purchase of houses and land. The average number of loan disbursements is generally higher for MDIs than for non-MDIs.

Table 3: Descriptive Statistics of Loan Disbursements by Product Types and Types of Financial Institutions in 2016

Interestingly, the ratio of non-collateral loans is higher for non-MDIs than for MDIs with 70% of business loans being non-collateral for non-MDIs but only 7% for MDIs. However, the ratio of loans with guarantors and the ratio of loans with land titles as collateral is higher for MDIs. This suggests that MDIs are more likely to extend loans through a group-lending scheme, or to take land as collateral. Figure 4 shows the changes in composition of MFI's loan portfolio by product types between 2016M1 and 2019M3. We aggregated the number and amounts of loan disbursements for each year by 8 types of loan products.[7] The definition of loan products is described in Appendix 1. Regarding the MDIs, we find that the total number of loan accounts declined from 2016 to 2018, while the total amounts lent increased. In particular, the increases in loan amounts were relatively large between 2016 and 2017. For non-MDIs, we find that the total number of disbursed loan accounts remained stable over time, while the total amounts of disbursed loans increased over the period. It is noted that several borrowers are often included in one loan account in the case where loans are disbursed as a group-lending loan or a joint-lending loan. Figure 4 shows the total number of borrowers over the period. Despite the decrease in the number of new loan accounts, the total number of borrowers constantly increased. The findings here indicate that MDIs and non-MDIs adjusted to the IR cap policy by increasing average loan

[7] In the CBC database, loans are categorized into major classifications (items of the first hierarchical level), and minor classifications (items of the second hierarchical level). The definition of loan products in our paper basically follows the major classifications, except with regard to community loans and agricultural loans. Agricultural loans are one of the minor classifications in business loans, and community loans are one of the minor classifications of social loans. However, because the number of disbursements of these loans are large, they are by nature different from other business and social loans. Thus, in this paper, we make independent categories for these two loans, and categorize loan disbursements in the CBC data into personal finance, mortgage loans, business loans, social loans, credit card, institutional loans, community loans, and agricultural loans.

sizes and decreasing the number of newly disbursed loans, while they kept growing the number of borrowers by increasing the number of borrowers per loan account.

Figure 4: Composition of Loans by Products

Figure 5: Number of Borrowers

Figure 6 shows the composition and trend of total loan disbursements by size between 2016M1 and 2019M3. The composition of loan disbursements shows that loan disbursements smaller than USD 500 dominate the substantial shares of total loan disbursements by MFIs. Specifically, loans of less than USD 500 were dominant at around 50% in both MDI and non-MDI loan portfolios in 2016. However, the share of loans of less than USD 500 in MDI loan disbursements decreased significantly shortly after 2017M4. These findings might indicate that the policy particularly affected small-sized loans, and that MDIs reacted more significantly than non-MDIs.

Figure 6: Composition of Newly Disbursed Loans by Size

Figure 7 illustrates the trends in the total number of loan disbursements as a means to understand which loan sizes decreased after the IR cap policy was implemented. To compare the trend across loan sizes, we took a logarithm for the number of loan disbursements and adjusted the numbers at zero for all loan sizes in March 2017. Panel A shows that the total number of loan disbursements of less than USD 500 significantly declined for both MDIs and non-MDIs in 2017M4. In addition, the decline was larger for MDIs than for non-MDIs. In the same period, larger sized loans increased after the implementation of the IR cap policy, particularly for loans of USD 500-1,000, and loans of USD 500-1,000 and USD 2,000-3,000 for MDIs.

In Panel B of Figure 7, we present the trend in the total number of loans of more than USD 5,000. The total number of loan disbursements has constantly increased for all loan sizes. Even though shortly after the introduction of the IR cap policy there was a steep decline in all loan sizes for both non-MDIs and MDIs, within half a year the number of loan disbursements was back to the same trend. This suggests that the introduction of IR cap policy did not have a significant persistent negative impact on large loan disbursements, while there have been persistent declines in small-size loans for both MDIs and non-MDIs.

Figure 7: Trends in the Total Number of Loan Disbursements Before and After the Introduction of the Interest Rate Cap Policy

We now turn to the changes in lending behavior by non-MDIs and MDIs. Loan sizes significantly increased from 2016M1 to 2019M3, and the number of borrowers started concentrating in urban areas just after the policy was introduced. Figure 8 shows the average loan sizes per loan account from 2016M to 2019M3. The average loan size is in general larger for MDIs than it is for non-MDIs, and is larger in urban areas than in rural areas.[8] Although there was an increasing trend in average loan size from 2016M1 to 2019M3, the average loan size became larger in rural areas for non-MDIs after the introduction of the IR cap policy (increasing from about USD 1,000 in 2016M1 to USD 2,000 in 2018M12). In addition, the average loan size constantly increased between 2016M1 to 2019M3 in both rural and urban areas, while the pace of the increase in urban areas grew after the IR cap was introduced (from about USD 3,000 to about USD 6,000 in urban areas and from about USD 1,500 to about USD 3,000 in rural areas).

Figure 8: Changes in the Average Size of Loans per Loan Account

[8] In our definition, urban areas refer to communes in Phnom Penh and in the capital district of each province; all other communes are referred to as rural areas.

Figure 9 shows the average number of loan disbursements in urban and rural areas before and after the interest rate cap was introduced. We calculated the average number of loan disbursements per commune-MFI pair and plotted the 95% confidential intervals. We find that the average number of loan disbursements in rural and urban areas followed the same trend and decreased compared to urban areas before the IR cap policy, while the trends were different between urban and rural areas after the policy was introduced. Additionally, the average number of loan disbursements increased in urban areas but remained stable in rural areas. The results suggest that both non-MDIs and MDIs started concentrating on urban areas, possibly because it became difficult to make a profit from rural households under circumstances where interest rates were low.

Figure 9: Changes in Number of Loan Disbursements per Commune

The reactions to the IR cap policy in lending differs between MDIs and non-MDIs. Additionally, it appears that the reactions of MDIs and non-MDIs differ across loan products. Figure 10 shows the trend in total number of loan disbursements by product. For each product type, we aggregated the number of loan disbursements by types of financial institutions: MDIs and non-MDIs. To compare the trend across loan types, we take a logarithm for the number of loan disbursements and the numbers were adjusted at zero at March 2017. For non-MDIs, changes in the number of loan disbursements were large for business loans, community loans, and agricultural loans. Specifically, the numbers of loan disbursements were lower than zero for business loans and agricultural loans after April 2017, meaning that the numbers of these loan disbursements decreased after the IR cap policy was introduced. By January 2018, the number of community loan disbursements had jumped. As seen in Figure 10, for MDIs, the number of social loans, community loans, and agricultural loans was constantly lower than zero after April 2017.

This, suggests that there were declines in the number of loan disbursements for these types of loans.

Figure 10: Trend in Total Number of Disbursed Loans by Loan Products

The substantial share of microfinance loans was group-lending and joint-account loans. Thus, several borrowers may be involved in one loan account. Figure 11 shows the average number of borrowers per loan account for all loans made by MDIs and non-MDIs. For both institutions, the average number of borrowers per loan account increased after the IR cap policy was implemented. This can be explained by the large fixed cost per loan in microfinance loans. Loan provisions require proportionally large fixed costs per loan, although financial institutions need to reduce their fixed costs in loans in circumstances where the IR cap is low. In response to the 18% interest rate cap, both non-MDIs and MDI may increase the number of borrowers in one loan provision in order to keep total number of borrowers in the whole loan portfolio.

Figure 11: Number of Borrowers per Loan Account

5. Impacts of Interest Rate Cap on MFI Loan Conditions

5.1 Empirical Model

In this section, we examine the causal impacts of the IR cap policy on loan disbursements of MDIs and non-MDIs. However, it is difficult to empirically identify the causal impact of the IR cap policy. Since all MFIs are affected by the IR cap policy, the impact of this policy and other changes in macroeconomic or regulatory conditions are likely to be mixed in the estimation. To address this issue, we use the small non-commercial loans from commercial banks as a control group and employ difference-in-difference estimation to estimate the impact of policy introduction on the

credit conditions. Since the IR cap policy was only introduced to MFIs, the commercial banks were able to set interest rates above 18%. Specifically, we use the following equation for estimating the impact of the IR cap policy.

$$y_{i,k,b,t} = a + \beta_t \ \ MFI_b \cdot Time_t + v_b + \pi_k + \mu_t + e_{i.k,b,t} \quad (1)$$

$y_{i,k,b,t}$ represents the characteristics of the disbursed loan account i from financial institution b in commune k at period t. MFI_b is the dummy for loans disbursed from MDIs or non-MDIs. $Time_t$ is a vector of time dummies. For the sake of simplicity, we set t=1 in the period the IR cap policy was introduced (2017M4). For the outcome variable $y_{i,k,b,t}$, we use the following indicators:

- Amount of loan disbursement.
- Maturity.
- Dummy variable of whether female borrower is involved.
- The number of borrowers per loan (the sample is reduced into group lending loans only).
- Dummy of local currency.
- Dummy of no collateral requirement.

To estimate the causal link between the dependent variable and the IR cap policy, we examine the time trend in the difference between MFI and commercial banks (β_t). If the interest rate cap policy affects MFIs immediately, the estimated β_t will show a different trend for $t > 0$, compared to $t \leq 0$. In addition, we also examine the pre-trend in β_t. Specifically, we examine whether β_t shows a parallel trend before the IR cap policy. If the estimated β_t violates the parallel trend before the IR cap, there may be other causality in addition to the IR cap.

Taking advantage of granular data, we control the other factors affecting outcome variables. There may be a trend caused by seasonality, which could uniformly affect the demands

of borrowers on loans from all the financial institutions. To remove the seasonality or other macroeconomic effects that uniformly affect both commercial banks and MFIs, we include a time-fixed effect (μ_t). Furthermore, we also control for firm-fixed effect (v_b) and commune-fixed effect (π_k). We conduct the fixed-effect estimation with clustered robust standard errors at firm level.

To ensure that lending behavior is similar between the treatment and the control group, we focus on agricultural loans, community loans, and business loans of less than USD 5,000 for the estimation. Agricultural loans and community loans are generally extended in rural areas, and small-sized business loans are generally extended to micro, small or medium-sized firms. Thus, the customer segment of those loans is likely to overlap between commercial banks and MFIs. Heng et al. (2021) also estimated the impact of the IR cap policy in Cambodia by comparing commercial banks and MFIs at the firm level. However, since their data source was the financial statements of each financial institution, the loan data are aggregated from commercial and individual loans. Most commercial bank loans are loans for larger firms; thus, their choice of control groups is not appropriate. In our study, by comparing similar loans between commercial banks and MFIs, we estimate the more precise impact of the interest rate cap policy.

Aside from the differential impact of the policy between commercial banks and MFIs, this policy may affect MFI behavior differently across different levels of pre-regulated interest rates. Even though the IR cap policy affected all of the MFIs in Cambodia, MFIs which imposed higher interest rates before the policy implementation were more likely to be affected, since it was more effort for them to adjust their loan portfolio to meet the policy. Thus, by examining the heterogeneity in the impact of the IR cap policy across the different levels of pre-regulated interest rates of MFIs, we also test whether the IR cap policy had a causal impact on lending behavior among MFIs. Specifically, we employ difference-in-difference-in-difference (DDD) estimation exploiting heterogeneity in assessing the effect of IR cap policies, and control for other possible effects.

$$y_{i,k,b,t} = a + \beta_{1,t}\ \ MFI_b \cdot Time_t + \beta_{2,t}\ \ MFI_b \cdot Time_t \cdot Interest\ \ Rate_b + v_b + \pi_k + \mu_t + e_{i.k,b,t} \quad (2)$$

where $Interest\ \ Rate_i$ is the average interest rates of MFI i in 2016. We define this variable as interest income divided by amounts of loans. If $Interest\ \ Rate_i$ is higher, the MFIs are likely to have loans with high interest rates in their portfolio. If the IR cap policy has heterogeneous impacts on MFIs depending on high pre-regulated interest rates, there would be changes in the estimated value of $\beta_{2,t}$ between at t>1 and at t<0.v

Furthermore, the impact of the IR cap could be different across the pre-regulated level of competition. To examine this hypothesis, we use a Herfindahl-Hirschman Index (HHI) to capture the market structure. HHI is defined as the sum of squared market share in a commune k ($HHI_k = \Sigma a_{b,k}^2$, where we denote $\alpha_{b,k}$ as the market share of MFI b in commune k). HHI is ranged from 0 to 1, and is often used to proximate the competition in the banking sector. As HHI is close to 1, market structure is monopolistic, while HHI gets close to 0 as the number of firms increases or the market share is uniformly distributed across firms. We define the market share as the number of loan disbursements by one MFI over the total number of loan disbursements of all the MFIs in the commune for each year. To assess whether the impact of the IR cap is different between the competitive market and oligopolistic market, we estimate the following equation:

$$y_{i,k,b,t} = a + \beta_{1,t}\ \ MFI_b \cdot Time_t + \beta_{2,t}\ \ MFI_b \cdot Time_t \cdot HHI_{k,2016} + \beta_{3,t}\ \ Time_t \cdot HHI_{k,2016}\ \ + \beta_{4,t}\ \ MFI_b \cdot HHI_{k,2016}\ \ + v_b + \pi_k + \mu_t + e_{i.k,b,t} \quad (3)$$

To capture the heterogeneous impact across different levels of competition among MFIs, we include the interaction term of time dummies and HHI. To avoid the endogeneity problem, we

set HHI as the values of 2016 and time-invariant in the model. We suppose that $\beta_{2,t}$ would capture the heterogeneous impact of the IR cap policy across different levels of HHI.

5.2 Results

Figure 12 shows the estimated coefficients of interaction terms of MFI dummies and time dummies (β_t). Dashed lines in each panel represent the average estimated coefficient (β_t) before the IR cap. Some of the variables show that there was a jump in the time trend shortly after the IR cap. Particularly, in the loan amounts, the estimated β_t jumped just after the IR cap was introduced; there is no clear pre-trend. The result means that MFI loans were smaller than bank loans at statistical significance before the IR cap, but the difference in loan size suddenly disappears after the IR cap. This suggests that MFIs increased the size of loans to the same average size of bank loans. The jump in the estimated β_t from 2017M3 to 2017M4 was 0.209, suggesting that the IR cap increased the amount of loan per disbursement by 20% on average.

Figure 12: Estimated Coefficients of Interaction Terms of MFI Dummies and Time Dummies (β_t)

The same results expressed above were also observed for non-collateral loans. Before the IR cap there was a difference in the probability that MFIs or banks would extend non-collateral loans. In contrast, after the IR cap there is a decreasing trend and the probability becomes close to that of banks. This suggests that MFIs started decreasing the probability of extending non-collateral loans after the IR cap. The estimated β_t is 0.05 in 2017M4, while it decreased to 0.024 in 2017M10, suggesting that the IR cap policy reduced the provision of non-collateral loans by about 2.6% in half a year.

There is also a decreasing trend in the probability of extending KHR currency loans and female-related loans over the time. However, there is a pre-trend for both variables. For the female-related loans, β_t constantly decreases from the beginning of our sample period, suggesting that MFIs started decreasing loans to female borrowers, or that banks started increasing loans to female borrowers due to factors other than the IR cap. Thus, the IR cap may have had a smaller impact on MFI's policies for extending female-related loans.

For the KHR currency loans, β_t started decreasing around 2016M12, which is the period before the IR cap was announced and implemented. This timing is in line with the date when NBC announced the introduction of a new regulation to address the currency denomination of loan portfolios. The new regulation stipulated that all financial institutions must ensure that more than 10% of the loan portfolio is denominated in local currency. The regulation took effect at the end of 2019. At the time of the announcement, almost all of the commercial banks failed to achieve the 10% minimum. However, MFIs extended KHR currency loans even before the announcement of this regulation. Even though there are some MFIs that lend primarily in USD, the portfolios of MFIs are smaller than those of commercial banks. Thus, this regulation is less binding for MFIs than for banks. The decreasing trend in β_t at 2016M12, therefore represents the impact of the announcement of this policy on commercial banks.

Even though an immediate jump was not observed after the IR cap, there are changes in β_t after 2018M1 for KHR currency, maturity, and the number of borrowers per loan. The difference in maturity of loans, the probability of lending in KHR currency, and the number of borrowers per group lending between MFIs and commercial banks has started to decline.

In terms of regulations and asset sizes, there are differences between non-MDIs and MDIs. MDIs can collect deposits from the public, and their asset sizes are in general larger than non-MDIs. The prudential regulations are tighter for MDIs than non-MDIs. Thus, the impact on MDIs and non-MDIs may differ. We also estimated Equation 1 using different sub-samples of MFIs. Figure 13 shows the results of estimation with the sub-sample of MDIs and banks, and the sub-

sample of non-MDIs and banks. The estimated trend of β_t is similar between MDIs and non-MDIs in each outcome variable before and after the interest rate cap, meaning that the lending behavior is similar between MDIs and non-MDIs and the impacts of the policy also affected both types of MFIs similarly.

Figure 13: Estimation with Sub-Sample of "MDI vs Bank" and "Non-MDI vs Bank"

Next, we further investigate the differences in the impact of the IR cap policy on MFIs in relation to the levels of pre-regulated interest rates. We estimated Equation 2 using the same sample of loan disbursements for MFIs and commercial banks. Likewise, we excluded loans of more than USD 5,000 from the sample and limited the sample to business loans, agricultural loans, and community loans. In the estimation, we conducted the fixed-effect estimation with clustered robust standard errors at firm level. Figure 14 shows the estimation results of the coefficient of triple interaction terms of pre-regulated interest rates, MFI dummy, and time dummies (β_{2t}). The statistical significances in the impacts of the IR cap are particularly pronounced for loan amount and collateral requirements. The result show that differences in loan sizes between MFIs with higher interest rates and with lower interest rates decreased after the IR cap. In a similar way to the differences between commercial banks and MFIs (discussed earlier), the difference between high-interest-rate and low-interest-rate MFIs also disappeared, suggesting that those MFIs that set higher interest rates before the IR cap increased the loan size per disbursement more than those that had set lower interest rates before the IR cap. In addition, the statistical difference in probability of extending non-collateral loans also disappeared after the IR cap policy.

Figure 14: Estimated coefficients of Triplet Interaction Term of Pre-regulated Interest Rates

The results show that the probability of KHR currency loans also decreased after the IR cap. However, the decreasing trend could be observed before the IR cap policy, suggesting that there were factors other than the new regulation on currency denomination that impacted the probability of extending KHR currency loans. MFIs that have lower-pre-regulated interest rates are likely to extend loans to urban areas and those loans are likely to be in USD. Thus, there was a declining trend in estimated β_{2t} after 2016M12.

Interestingly, since 2018M1, the maturity of loans has increased for MFIs with higher pre-regulated interest rates. This suggests that long-term loans increased for those MFIs relative to short-term loans. However, as shown in Figure 12, the maturity of loans for MFIs decreased compared to commercial bank loans after the IR cap. Thus, the impact of the IR cap on maturity is not clear for MFIs with higher pre-regulated interest rates.[9]

Next, we present the results of the estimation of Equation 3 in Figure 15. We estimated Equation 3 using the same sample of loan disbursements from MFIs and commercial banks as we used for Equations 1 and 2. As with the first two equations, we excluded loans of more than USD 5,000 from the sample and limited the sample to business loans, agricultural loans, and community loans. In the estimation, we conducted the fixed-effect estimation with clustered robust standard errors at firm level. In Figure 15, we present the estimated coefficient of the triple interaction terms of HHI, MFI dummy, and time dummies (β_{2t})

Figure 15: Estimated Coefficients of the Triplet Interaction Term of HHI

Compared to the heterogeneous effect across pre-regulated interest rates, there are no clear jumps after the IR cap policy. For the most of outcome variables, there were no significant changes in the trend over time, or the changes in the trend were not consistent with the timing of

[9] Using regression analysis, Aiba et al. (2020) shows that the probability of extending long-term loans relative to short-term loans increased after the IR cap for MFIs. However, their analysis does not consider the causal link in these results.

the IR cap. We find that there was an increasing trend in female-related loans in the areas where HHI was high in 2016. However, the increasing trend can be seen even before the IR cap policy. Thus, apart from the IR cap, there were other factors affecting selection of female borrowers in low competitive areas.

This result might suggest that competitiveness was less associated with the impact of the IR cap. Instead, the characteristics of the borrowers and the loans were important to determine the impact, as found in the previous sections. One possibility is that MFIs do not exercise market power even in the oligopoly markets. Since generally the objective of MFIs is to extend loans to the poor, the IR cap could possibly be set without the high markup. Thus, there were no statistically significant differences in the impact of the IR cap between the areas where HHI is high and where it is low.

6. Impacts on Borrower's Access to Loan Markets

6.1 Empirical Model

In Section 5, we observed that MFIs increased the loan amount per disbursement significantly after the interest rate cap. However, it is still unclear whether borrowers who borrowed small amounts started borrowing large amounts, or whether those who borrowed small amounts were excluded from the financial market.

In this section, we examine whether borrowers lost access to financial institutions after the interest rate cap policy. Using credit registry data from Belgium, Jonghe et al. (2020) analyzed the financial access of firms after the negative funding shocks of 2008. Following his analysis, we analyze the financial access of households after the IR cap policy in Cambodia. The analysis is conducted in cross-sectional design. We estimate a linear probability model of borrower's access to the formal financial market after the interest rate cap policy.

Our analysis is focused on MFI borrowers before the IR cap. Figure 15 illustrates the sample we analyze in this econometric framework. Using the CBC data, we identify people who borrowed from MFIs in the period between 2016m1 and 2017m3. Since our sample period is limited to the period between 2016m1 and 2019m3, we focus on borrowers whose loans are of a maturity less than 24 months before the IR cap. We further divide the sample into: (1) people who borrowed from MFIs before 2017M4 but did not borrow from formal financial institution after 2017M4, and (2) people who borrowed from formal financial institutions before 2017M4 and also borrowed from formal financial institutions after 2017M4.

Figure 16: The Segmentation of the Sample to be Analyzed

We make a dummy of *keeping financial access* for Group 1. By comparing Group 1 and 2, we examine the factors that influenced who was still able to access the financial markets after the IR cap. Specifically, we estimate the following equation:

$$Access_{i,t>2017m4} = \alpha + +\beta_1 X_{i,t<2017m4} + \beta_2 B_{i,t<2017m4} + \gamma_1 X_{i,t<2017m4} + \gamma_2 B_{i,t<2017m4} + f_t + \epsilon_i \quad (4)$$

where $Access_{i,t>2017m4}$ is a dummy variable which represents whether a person *i* borrowed from formal financial institutions after the IR cap policy. $X_{i,t<2017m4}$ represents borrower characteristics before the IR cap policy. For the borrower characteristics, we include the gender dummy (whether or not the borrower is female), the number of borrowing experiences before the IR cap, and an urban area dummy. $B_{i,t<2017m4}$ is a vector of variables which represent the characteristics of loans the person *i* had before the IR cap. For loan characteristics, we include the average size of loans, which is the average amount of loans the person *i* had before the IR cap. We further include a non-collateral loan dummy and a KHR loan dummy. The dummy variables

take one if the person had at least one loan belonging to the category before the IR cap. For example, if the person had agricultural loans and business loans before the IR cap, the agricultural loan dummy and the business loan dummy both take one. We also include the dummies for lending scheme. There are three categories of lending in the CBC database: group lending, joint-account lending, and individual loans. We created a dummy for each of lending schemes.

Since there may be a seasonality in the loan conditions, the timing of borrowing may also correlate to the loan conditions ($B_{i,t<2017m4}$). To control this time effect, we also include time dummies (f_t) which represent the timing of when the person borrowed before the IR cap. The time dummies are created on a monthly basis. We also include product dummies and commune dummies. However, since this analysis is essentially conducted in a cross-section setting, we do not include the individual person dummy in the estimation.

We present the frequency of the sample of keeping access to formal financial institutions after the IR cap policy. The total sample size is 1,208,591, meaning that in 2016, 1,208,591 people took out loans of less than 24 months from formal financial institutions. Out of the total sample, 71.9 percent also borrowed again from financial institutions between 2017M4 and 2019M3. In other words, 27.1 percent of the borrowers lost access to the formal financial institutions after the IR cap policy. Compared with commercial banks, the ratio of loss of access is high for MDIs and non-MDIs.

Table 4: Frequency of Sample of Access to Formal Loans

6.2 Results

We estimate Equation 3 using an OLS estimation with cluster-robust standard errors at commune level for the sub-sample of loans of less than USD 5,000. We present the results of the estimation in Table 5. In columns 1-3, we present the results of MDIs, non-MDIs, and commercial banks,

respectively. We find that the average loan size before 2017M4 is positively associated with financial access. This suggests that households that borrowed large amounts were likely to keep accessing formal financial institutions, while households that borrowed small amounts were more likely to stop rolling over loans after the IR cap. The estimated coefficient suggests that if the average loan size increased by two times, the probability of retaining access increased by 4.64% for MDIs and by 4.23% for non-MDIs. In the previous sections, we stated that the size of loans from MFIs increased as a result of the IR cap. Subsequently, the results of the analysis in this section suggest that the increase in the size of MFI loans was partly due to the MFI's selection of borrowers with a low-risk profile.

Table 5: Impact of the IR Cap on the Financial Exclusion of Borrowers

In columns 4-6, we also included the sample of commercial bank loans, and tested the difference in probability of retaining financial access between MFIs and commercial banks. We find that the coefficient of MFI dummy was not significant for the full sample and the sub-sample of MDI and commercial banks (Columns 1 and 2), while it was negatively estimated at statistical significance in the sub-sample of non-MDIs and commercial banks (Column 3). This suggests that on average there are no significant differences in financial access between MDI borrowers and borrowers of commercial banks, while non-MDIs were more likely to stop lending to their customers than commercial banks were. However, the estimated coefficient can be translated into a 1.2% difference between non-MDIs and commercial banks in the probability that people would continue to borrow after the IR cap.

We find that there are differences in changes in financial accessibility across types of borrowers. First, we find that the coefficients of individual loans are estimated as positive for both MDIs and non-MDIs. In addition, the coefficient of the group-lending dummy was lower than that of the individual loan dummy, and was even negative for MDI borrowers. This finding

suggests that people who borrowed through group loans were less likely than borrowers of individual loans to retain access to financial institutions after the IR cap. People who borrowed in groups are supposed to be relatively poor and vulnerable. Thus, it suggests that, after the IR cap, people who took out group-lending loans from MDIs are more likely to lose financial access than borrowers who took out a group loan from a commercial bank or non-MDI. Additionally, we find that the non-collateral loan dummy was negatively associated with financial access to non-MDIs, which suggests that people without collateralizable assets began to be excluded from the financial market.

In contrast, we find that female borrowers are more likely to retain financial access than male borrowers. The coefficient was estimated as positive, suggesting that female borrowers are more likely to continue access than male borrowers. In the previous section, we found that the MFI's lending to female borrowers has been decreasing relative to commercial banks. However, MFIs did not necessarily expel existing female borrowers after the IR cap policy was introduced. We also reached similar findings for the urban dummy, which was negatively associated to financial access. This implies that people in rural areas were more likely to retain financial access after the introduction of the IR cap policy. However, this trend is also found in relation to commercial banks. In general, there is a tendency for financial institutions to continue lending to the same customers in rural areas compared to urban areas.

Lastly, we find that the product dummies are also estimated at statistical significance. Since the baseline dummy is agricultural loans, the estimated coefficients represent the difference in financial access compared to agricultural loans. We find that the coefficients of the business loans dummy and community loan dummy were both positive for MDIs and non-MDIs, which indicates that after the IR cap, people were less likely to have access to agricultural loans than they were to business and community loans. In the previous analysis by Aiba et al. (2020), there was a reduction in the disbursement of agricultural loans after 2017M4. Thus, the results imply that the MFIs reduced loans for agricultural purposes to existing and new borrowers.

7. A Test of the Spillover Effect of the Interest Rate Cap Policy on Commercial Banks

We further investigate the impact of the IR cap policy on commercial banks, which are not subject to this regulation. Tantri (2018) documented that changes in the regulation of MFIs also affected the default rates for banks in India, although he did not identify the channel of spillover. To examine whether there could be a spillover into commercial banks, we collected data on interest rates on loans from each commercial bank on a monthly basis. The data is provided by NBC. Figure 17 shows the average and median of the impact of commercial bank interest rates on consumer loans. The interest rates of commercial banks also dropped shortly after the introduction of the interest rate cap policy. From this we can imply that commercial banks were also affected by the interest rate cap policy, even though the policy does not explicitly force commercial banks to set interest rates lower than 18%. The channel of transmission of the interest rate cap policy is possibly the recent intensive competition between commercial banks and MDIs/non-MDIs in consumer loan markets.

Figure 17: Commercial Bank Interest Rates on Consumer Loans

In August and September 2019, we conducted interviews with managers from seven MDIs and four non-MDIs. We asked the managers to say which financial institutions are their main competitors. The answers are summarized in Table 10. Interestingly, most of the MFIs answered that they were competing with commercial banks in addition to other MFIs.[10] The results also support the view that there has been intensive competition between MFIs and some commercial banks, and customers overlap between some commercial banks and the MFIs.

[10] In the interview, some respondents from different MFIs also mentioned that a certain commercial bank had obtained 200 credit officers who used to work for MDIs, and the clients of the credit officers also moved to the commercial bank.

Therefore, the IR cap policy has an indirect impact on commercial banks and the impact might be channelled through the competition between some commercial banks and the MFIs.

Table 6: Answers About the Main Competitors of MFIs

It is noted that, at the end of 2016, NBC announced the introduction of a new regulation on currency denomination in loan portfolios. The new regulation stipulated that all financial institutions must ensure that more than 10% of their loan portfolios is denominated in local currency. The regulation took effect at the end of 2019. Almost all of the commercial banks did not achieve the 10% at the time of the announcement. Thus, to some extent the changes in interest rates on KHR loans reflect the impact of this announcement.

To confirm the spillover effects of the IR cap onto the loan conditions of commercial banks, we estimated the time effect within the commercial bank loans sample. We use the same sub-sample of business loans, agricultural loans, and community loans as we used for the estimates in Section 4.

$$y_{i,k,b,t} = a + \beta_t \ \ Time_t + v_b + \pi_k + e_{i.k,b,t} \quad (4)$$

where $y_{i,k,b,t}$ represents characteristics of disbursed loan account i from financial institution b in commune k at period t. We also control firm-fixed effect (v_b) and commune-fixed effect (π_k). Although the estimated time effects do not necessarily represent the indirect effects of the IR cap policy, there would be a jump after the IR cap policy was introduced, if the IR cap affected small loans from commercial banks in the short-term.

The results of the estimation are illustrated in Figure 18. The estimated time effects show that there was no clear jump in any variable immediately after the IR cap policy. For some variables, there is a jump or changes in the trend of time effects during the period of our study,

although the jump or changes do not seem to be consitent with the timing of the IR cap policy. For female-related loans, there was an increasing trend even before the IR cap was introduced. In addtion, for lending in KHR currency, there is some jumps in the trend of time effects after the IR cap. However, the jump is not conistent with the timing of the implementation of the IR cap, but is more consitent with the timing of the NBC announcement of the regulation on currency denomination at the end of 2016. It can therefore be inferred that the IR cap policy did not have a significant short-term impact on the currency denomination of commercial bank loans.

Figure 18: Estimated Time Effects for Commercial Bank Loans

In a similar manner to the impact that the IR cap had on MFIs, some loan condition variables, such as loan size, maturity of loans, and number of borrowers, have increased in the long run. Even though the long-term effects are difficult to estimate precisely in this setting, there may be some impact from the IR cap policy. Overall, the analysis of time effects on loan conditions of commercial banks suggest that there could be no significant spillover effect of the IR cap policy on the loan conditions of commercial banks, at least in the short run.

8. Conclusions

Using the account-level data of loan disbursements obtained from the CBC's credit registry database, we examined the impacts of the IR cap on lending by microfinance institutions in Cambodia, and financial access for MFI borrowers. The detailed data allowed us to investigate the causal impact of policy implementation on various loan conditions. Using the difference-in-difference method, we found that the average size per loan was particularly affected by the IR cap policy. Moreover, provision of non-collateral loans was also affected by the IR cap policy. Those results suggest that borrowers of costly (or risky) loans from MFIs are likely to be excluded from

the market after policy implementation. The study further found that the IR cap policy affected the outreach of MDIs and non-MDIs, as it had a negative impact on financial access for people who had smaller-sized loans, group-lending loans, and non-collateral loans after the IR cap policy. However, the impact was less pronounced for existing female borrowers and borrowers from rural areas.

From our analysis, we draw a number of policy implications. Setting lower interest rate ceilings makes MFIs reduce their outreach, since the MFIs need to reduce the costly loans to maintain the sustainability of their operations. The nature of MFI lending entails larger fixed costs, and interest rates become particularly high for smaller loans. Therefore, the interest rate cap policy affected the average size of MFI loans, since MFIs need to maintain a certain profit from loans per borrower, and one of the possible ways to keep lending to the poor at a lower interest rate is to decrease the proportion of fixed costs to a loan by increasing loan size. Our findings are consistent with this theoretical prediction of MFI lending behavior, and we further find that households of costly loans still experienced a loss of opportunities to access formal credit. It can also be inferred from the results that there may be an increasing need for households to have access to informal finance, such as pawn shops or loan sharks, in cases where household incomes experience negative shocks. In fact, there were several credit operators that transformed into pawn shops. Thus, the IR cap policy increased the administration costs of the regulators because more stringent monitoring of informal finance is now needed (Heng 2021). The IR cap policy per se could be effective in reducing the debt burden of borrowers and disciplining MFIs to push them to reduce costs. However, there may be negative side effects, as we have documented in this paper. The frequent adjustment of regulations based on evidence is required to mitigate such negative effects of policy. In order to facilitate the outreach of MFIs within a low interest rate environment, for the government needs to take some action including taking complementary measures or by adjusting the existing interest rates cap. From the practitioner's perspectives, the IR cap policy should be reviewed frequently, and adjusted to an appropriate rate based on the economic situation

of the MFI sector. For the complementary measures, arranging some subsidized funds for outreach-oriented MFIs or reducing reserve ratios for outreach-oriented MFIs which achieve lending to some target sector is also feasible measure.

We also found that there was a decreasing trend in provision of female-related loans, and the financial access of existing female borrowers was high, all else being equal. Those results suggest that the impact of the IR cap policy on female-related loans, *per se*, was limited. Our analysis in this paper focused on the causal impact. However, attributions of small-sized loans, group-lending and non-collateral loans are correlated to gender, and there is a generally decreasing trend in the provision of female-related loans. Still, we need to be aware that the impact of the IR cap could be negative for some female borrowers of costly loans, such as non-collateral and group-lending loans.

We further found an indication that the IR cap policy indirectly affected the interest rates of commercial bank loans, even though the impacts were much smaller than they were on MFI loans. This impact was possibly channeled through the competition between MFIs and commercial banks. Since some customer segments overlap between commercial banks and MFIs, as a response to a decrease in interest rates by non-MDIs and MDIs, commercial banks might face pressure to also decrease the interest rates on their loans in order to keep their customers. This may suggest that the regulatory framework should be designed with consideration of the commercial banking sector. However, we do not find that characteristics of commercial bank loans in our analysis changed significantly just after the IR cap policy, suggesting that there was not significant a spillover effect and our analysis may still be valid. Although analysis of the indirect effects of the IR cap on commercial bank behavior is out of our scope, it is important to investigate the behavior of commercial bank loans in microcredit in detail. As Tantri (2018) documented, changes in regulation on MFIs also affected bank's default rates in India.

Lastly, we should mention the challenges and limitations in our analysis. Analysis using the CBC database revealed that loan provision decreased for costly or risky loans. However, we

could not successfully distinguish supply factors from demand factors as determinants of this reduction. Some borrowers might be rejected or discouraged from borrowing after the interest rate cap policy was implemented ("Supply-side factors"). However, others might stop borrowing simply because they no longer have a needs ("Demand-side factors"). In the studies using credit registry data in other countries, some succeeded in distinguishing supply factors from demand factors. Those studies used the information in loan applications and rejections to estimate the impact of changes in bank lending policy on the rejection rate. However, in Cambodia such data are still not available, and our estimation still has challenges in estimating the supply and demand factors of loan granting processes by assessing the impact of interest rate cap policies.

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Table 1: Recent studies on interest rate cap policy in selected developing countries

Countries	**Background and Findings**
Kenya - Safavian and Zila (2018) - Ferrari et al. (2018) - Alper et al. (2018)	In August 2016, the interest rate cap policy was announced and was fully in effect by mid-September 2016. The interest rate cap was set at a level that could not exceed more than 4% above the base rate set by the Central Bank of Kenya. In addition, the floor rate for deposits was set at 70% of the base rate. **Results** The interest rate cap policy led to a significant reduction in the aggregate amount of lending. The composition of lending shifted away from small and medium-sized firms toward safer clients.
Bolivia - Heng (2015)	In August 2013, the Bolivian government adopted a new financial law to replace the 1993 banking law. The new law included interest rate caps and minimum lending quotas. The caps varied across sectors. For example, the interest rate caps were 11.5% for microfinance loans and 6% for SME loans. The quotas were set across types of financial institutions. For example, SME banks should keep at least 50% of total loans for SME and microenterprises, and commercial banks should keep at least 60% of total loans for the productive sector and social housing. **Results** New legislation led to an increase in the of loans by microfinance institutions, and the number of borrowers in the formal financial sector declined. Heng (2015) did not find clear evidence on the effect of interest rate caps and concluded that it is too early to observe the impact of the policy.
Chile - Madeira (2019)	New legislation on interest rate caps was adopted to reduce the existing caps on personal loans. The caps were differently applied across loan sizes. The caps were set at 14% and 7% higher than the average interest rate for personal loans between 200UF and 5,000UF (loans in this size range were not affected by the cap policy). The cap was gradually reduced from 54% in November 2013 to around 30% in December 2015 for loans of smaller than UF50. Likewise, the cap was reduced from 54% in November 2013 to 36% in December 2015 for loans of 50UF-200UF. **Results** Credit access declined after the new legislation. The estimated impact of the new legislation is a 9.7% reduction in the number of borrowers. The policy also affected lenders other than banks.
Zambia • Ferrari et al. (2018)	The Bank of Zambia introduced interest rate caps in January 2013. The cap was set at 9% above the policy rates set for banks by the Bank of Zambia. Non-bank (MFIs) and development MFIs were allowed to charge 1.6 and 2.3 times higher than the cap for banks, respectively. Thus, if the policy rate is 9.25, the caps are 18.25%, 30%, and 42% for banks, MFIs, and development MFIs, respectively. In November 2015, the Bank of Zambia removed all the caps, and announced new regulations for financial institutions to disclose their fees. **Results** The average loan size increased after implementation to reduce overhead costs for MFIs.
West African Economic and Monetary Union • Ferrari et al. (2018)	In January 2014, the interest rate cap was revised from 18% to 15% for banks, and from 27% to 24% for MFIs. **Results** The average interest rate significantly reduced.

Table 2: The Share of Commercial Loans to Total Outstanding Loans in CBC Data as of December 2019

	Balance	Number of Accounts
% of corporate loans as a share of total loans (MDI + non-MDI)	0.19%	0.0048%
% of corporate loans as a share of total loans (Commercial Banks and Specialized Banks)	19.99%	0.49%

Source: Authors' calculations using CBC database.

Table 3: Descriptive Statistics of Loan Disbursement by Product Types and Types of Financial Institutions in 2016

Product Types		Amount of loans		Maturity (Month)		KHR Currency (Dummy)		Collateral (Land) (Dummy)		No Collateral (Dummy)		Collateral (Gurantor) (Dummy)	
		Non-MDI	MDI	Non-MDI	MDI	Non-MDI	MDI	Non-MDI	MDI	Non-MDI	MDI	Non-MDI	MDI
Personal	Means	1,429	3,031	14	26	0.64	0.17	0.12	0.94	0.11	0.02	0.02	0.00
	N	162,016	178,530	161,985	178,521	162,016	178,530	162,016	178,530	162,016	178,530	162,016	178,530
Morgage	Means	6,620	6,751	37	39	0.05	0.06	0.63	0.98	0.32	0.00	0.00	0.00
	N	2,452	18,976	2,451	18,976	2,452	18,976	2,452	18,976	2,452	18,976	2,452	18,976
Business	Means	2,230	3,018	18	24	0.61	0.47	0.22	0.59	0.70	0.07	0.01	0.26
	N	50,156	310,265	49,666	309,730	50,156	310,265	50,156	310,265	50,156	310,265	50,156	310,265
Social	Means	636	609	5	15	0.05	0.79	0.01	0.09	0.25	0.05	0	0.70
	N	5,587	58,821	5,586	58,762	5,587	58,821	5,587	58,821	5,587	58,821	5,587	58,821
Institutional	Means	483		12		0.14		1.00		0		0	
	N	434	0	434	0	434	0	434	0	434	0	434	0
Community	Means	279	435	12	12	0.78	0.95	0.05	0.02	0.53	0.00	0.09	0.70
	N	11,565	516,308	11,416	514,348	11,565	516,308	11,565	516,308	11,565	516,308	11,565	516,308
Agriculture	Means	1,551	1,872	18	19	0.54	0.59	0.55	0.60	0.12	0.00	0.00	0.32
	N	28,400	364,910	28,399	364,826	28,400	364,910	28,400	364,910	28,400	364,910	28,400	364,910
Total	Means	1,576	1,761	15	19	0.61	0.64	0.19	0.42	0.24	0.02	0.02	0.42
	N	260,610	1,447,810	259,937	1,445,163	260,610	1,447,810	260,610	1,447,810	260,610	1,447,810	260,610	1,447,810

Source: Authors' calculations using CBC database.

Table 4: Frequency of Sample of Access to Formal Loans

	All Sample		MDI		Non-MDI		Bank	
Continue Borrowing	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
Yes	868,658	71.9	666,365	72.0	67,222	71.7	204,408	76.4
No	339,933	28.1	258,687	28.0	26,581	28.3	63,127	23.6
Total	1,208,591	100.0	925,052	100.0	93,803	100.0	267,535	100.0

Source: Authors' calculations using CBC database.

Table 5: Impact of the IR Cap on Financial Exclusion of Borrowers

	(1)	(2)	(3)	(4)	(5)	(6)
	Only MDI	Only non-MDI	Only Banks	All Sample	MDI & Bank	Non-MDI & Bank
Number of borrowing experiences	0.011***	0.005	0.011***	0.009***	0.009***	0.007***
	(0.002)	(0.004)	(0.003)	(0.002)	(0.002)	(0.002)
Average size of loans (Log)	0.067***	0.061***	0.047***	0.063***	0.063***	0.052***
	(0.002)	(0.004)	(0.002)	(0.001)	(0.002)	(0.002)
Maturity (Monthly)	0.000	0.000	-0.002***	0.000	0.000	-0.001***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Female Borrower Dummy	0.030***	0.028***	0.008***	0.022***	0.021***	0.012***
	(0.002)	(0.004)	(0.002)	(0.001)	(0.001)	(0.002)
KHR Currency Dummy	0.040***	0.026***	0.016***	0.029***	0.029***	0.021***
	(0.004)	(0.006)	(0.003)	(0.003)	(0.003)	(0.003)
Non-Collateral Loans	0.001	-0.020***	-0.080***	-0.025***	-0.017***	-0.034***
	(0.004)	(0.005)	(0.008)	(0.003)	(0.004)	(0.005)
Urban area dummy	-0.024***	-0.021**	-0.029***	-0.026***	-0.026***	-0.028***
	(0.005)	(0.009)	(0.005)	(0.004)	(0.004)	(0.005)
Lending Scheme						
Individual Loans	0.026***	0.053***	0.026***	0.031***	0.030***	0.040***
	(0.002)	(0.005)	(0.003)	(0.002)	(0.002)	(0.003)
Group Lending	-0.006**	0.022***	0.042***	0.004*	0.004*	0.034***
	(0.003)	(0.006)	(0.003)	(0.002)	(0.002)	(0.003)
Joint Account Lending (Baseline)	NA	NA	NA	NA	NA	NA
Product Dummies						
Business Loan Dummy	0.010***	0.014**	-0.007	0.05**	0.004*	-0.002
	(0.003)	(0.005)	(0.004)	(0.002)	(0.002)	(0.003)
Commune Loan Dummy	0.030***	0.049***	0.014***	0.027***	0.024***	0.027***
	(0.003)	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)
Agricultural Loan Dummy (Baseline)	NA	NA	NA	NA	NA	NA
MFI Dummy				-0.001		
				(0.003)		
MDI Dummy					0.001	
					(0.003)	
Non-MDI Dummy						-0.012***
						(0.004)
Product Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Commune Dummies	No	No	No	No	No	No
Constant	0.049***	0.082***	0.267***	0.081***	0.082***	0.205***
	(0.015)	(0.027)	(0.014)	(0.012)	(0.012)	(0.014)
Adjusted R-Squred	0.074	0.083	0.044	0.063	0.063	0.054
Observations	923083	93625	266939	1205850	1140922	355600

Note: The dependent variable is a dummy of whether a person with debts from MFIs retained access to formal financial institutions after the introduction of the IR cap. We perform an OLS estimation with cluster-robust standard errors at commune level. The sample is reduced to agricultural loans, business loans, and community loans, and the sample is also excluded if loan size is more than 5,000USD.

Table 6: Answers about the Main Competitors of MFIs

Interviewee	Competitior
MDI 1	N.A. (No Comments)
MDI 2	Acleda, Post Bank, ABA, Sathapana
MDI 3	AMK
MDI 4	ABA, Sathapana, Acleda, Prasac
MDI 5	ABA
MDI 6	ABA, Prasac, ACLEDA, HKL, LOLC, WB Finance, Prince, AMK, AMRET
MDI 7	ABA, Prasac, LOLC, AMRET, HKL, ACLEDA, Post Bank
Non-MDI 1	ABA, Canadia, DGB, Post Bank,Prasac, and HKL
Non-MDI 2	All of non-MDIs, especially Ly Hour
Non-MDI 3	ACLEDA, Prasac, Amret, and other MDIs
Non-MDI 4	ABA, Prince, Prasac, ACLEDA, HKL, LOLC, AMK, AMRET

Note: In the table, names of commercial banks are marked as blue. The interviews were conducted in August and September 2019. We selected 9 of the largest MFIs (7 MDIs and 2 non-MDIs), and two relatively small non-MDIs to interview about the changes in operation after the interest rate cap policy.

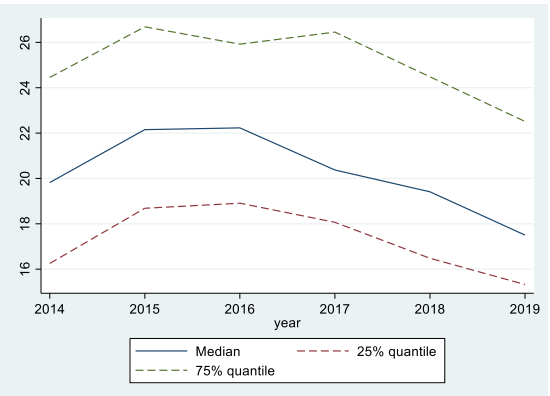
Figure 1: Average interest rate and average effective interest rate before and after introduction of the policy

Source: Authors' calculations using the NBC supervisory annual report 2006-2018.
Note: The estimation of average interest rates sometimes deviates from the interest rate actually imposed 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 2: Dynamics of Interest Rates and Effective Interest Rates Before and After the Policy Introduction

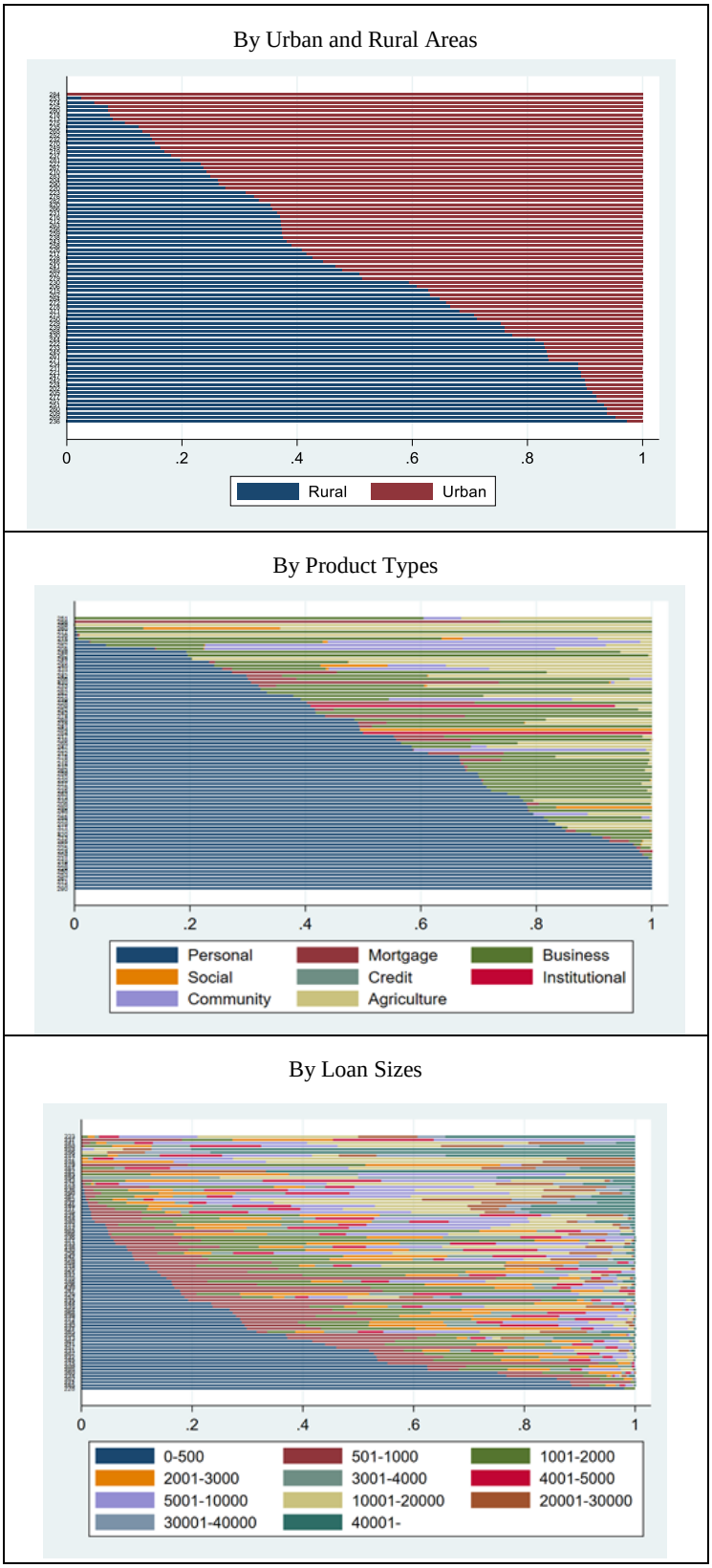
Panel A: Interest rate

Panel B: Effective interest rate



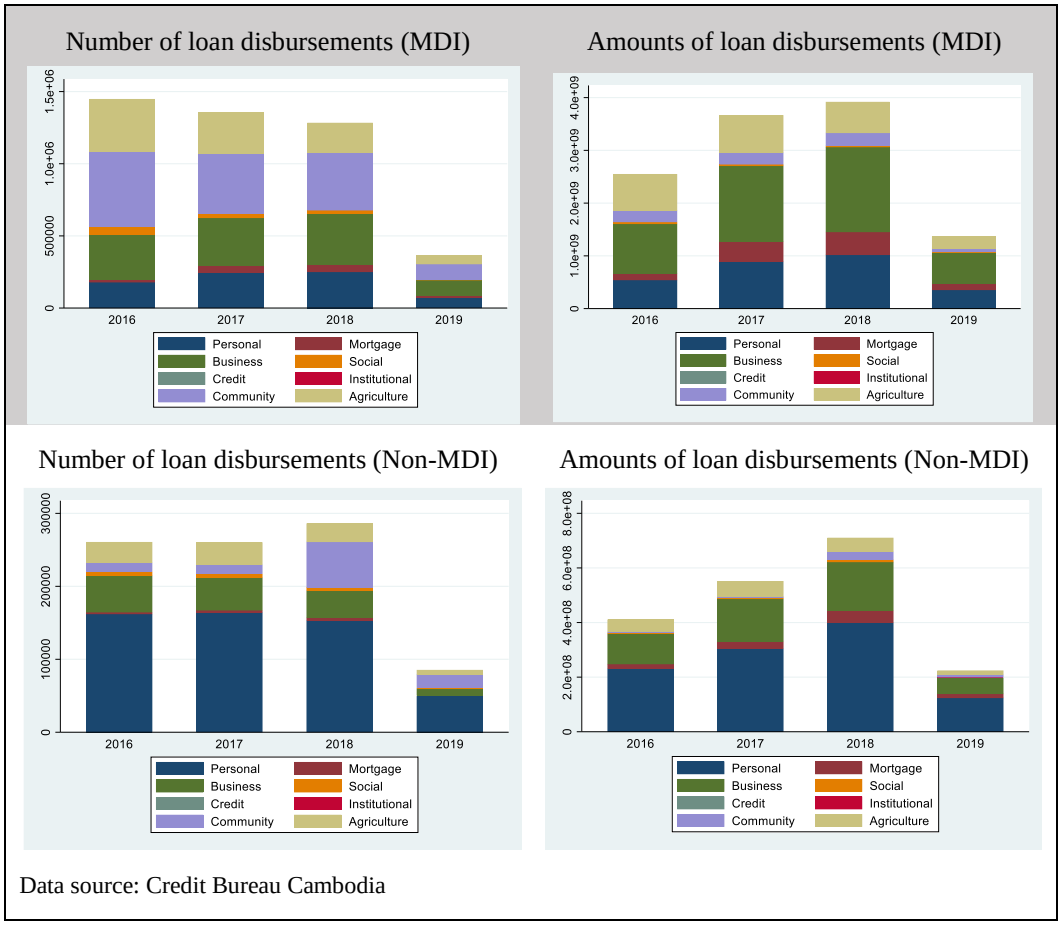
Note: Authors' calculations using NBC supervisory annual report 2014-2019. The data used here is a balanced panel. We dropped the MFIs which do not continuously exist in the data from 2014 to 2019.

Figure 3: Comparison of Loan Portfolio across Non-MDIs and MDIs



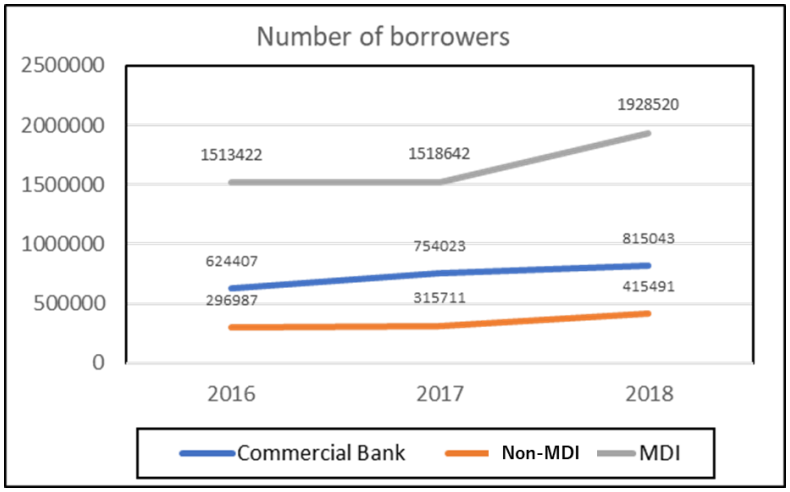
Source: Authors' calculations using CBC data. The figures show the compositions of loans by areas, product types, and by loan sizes for each MFI, respectively. The y-axis represents anonymized IDs of MFIs, and the x-axis represents the ratio.

Figure 4: Composition of Loans by Products



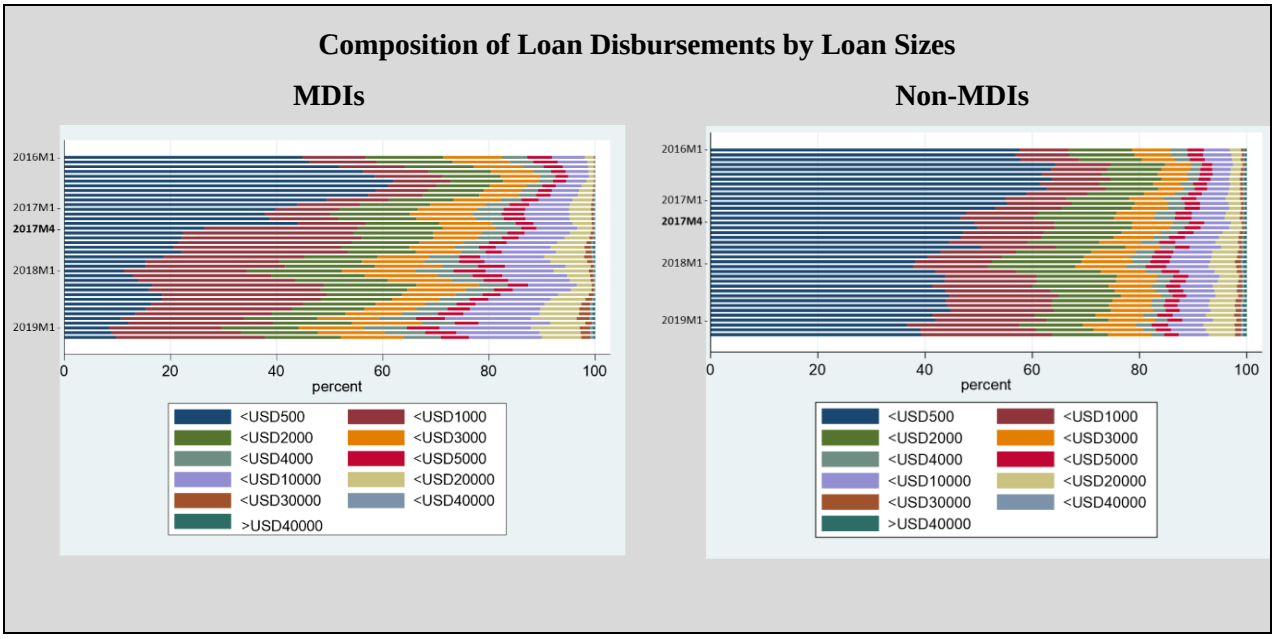
Source: Authors' calculations using the CBC database.

Figure 5: Number of Borrowers



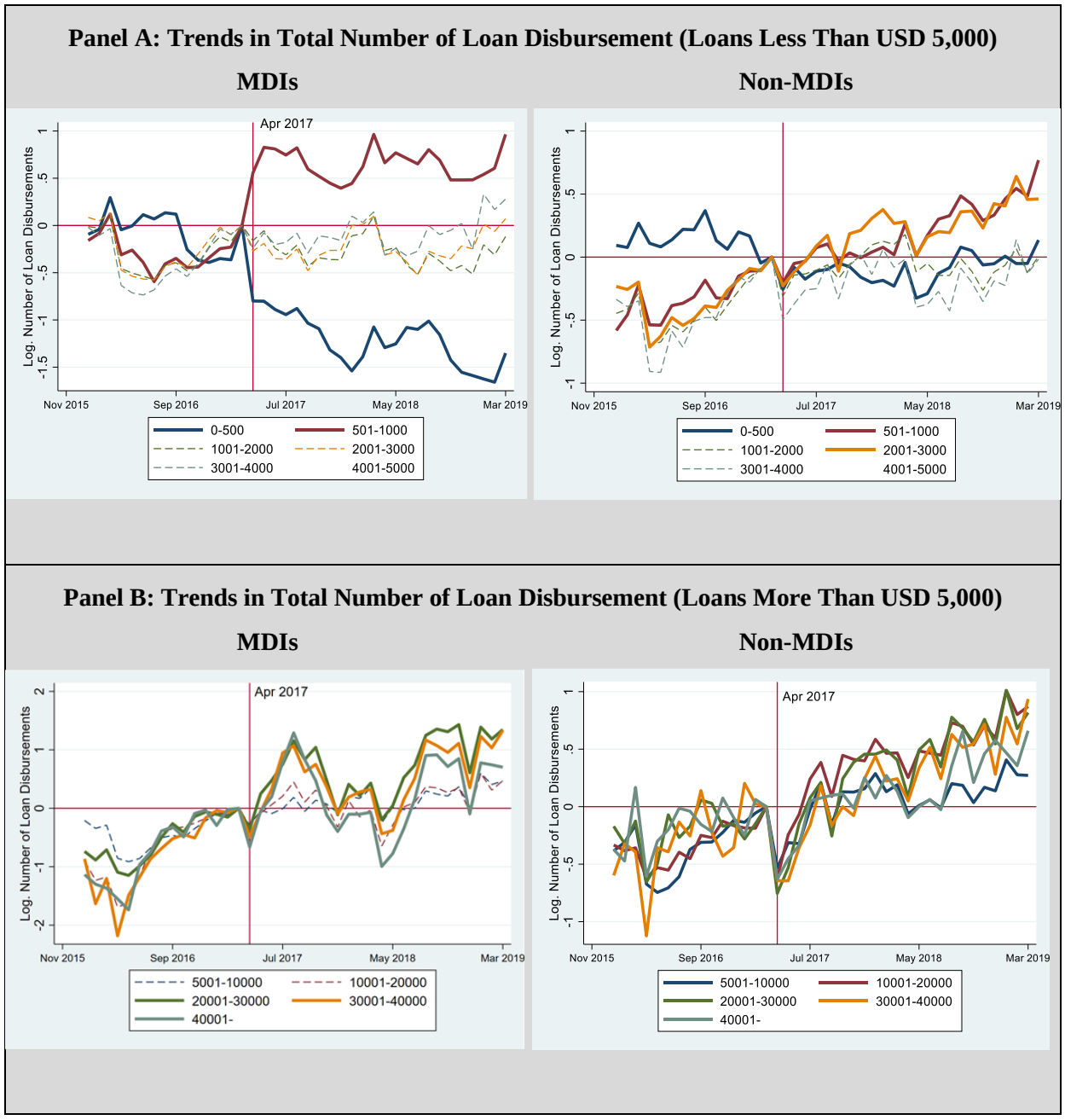
Source: Authors' calculations using the CBC database.

Figure 6: Composition of Newly Disbursed Loans by Loan Sizes



Note: Authors' calculations using the CBC database. In the legend, "<500USD" represents loans of USD 1-500, while "<USD 1,000" represents the loans of USD501-1,000. The same applies to the other labels.

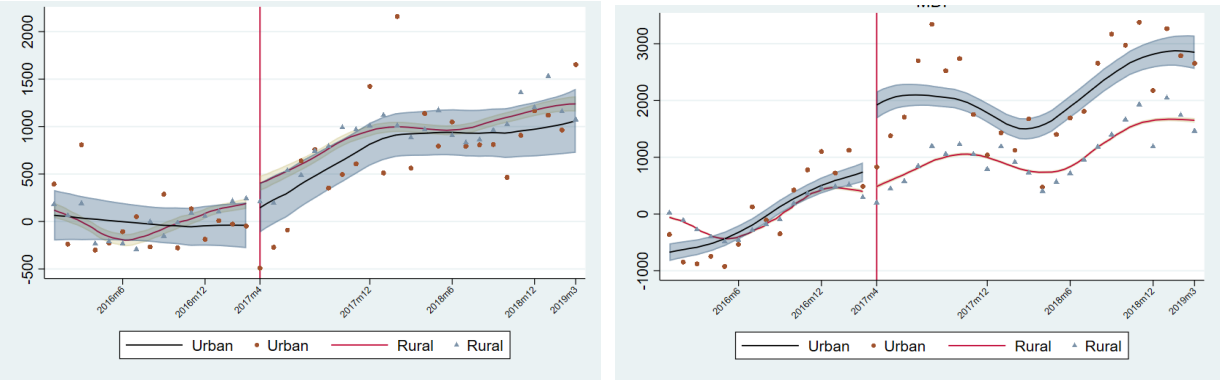
Figure 7: Trends in the Total Number of Loan Disbursements Before and After the Introduction of the Interest Rate Cap Policy



Source: Authors' calculations using the CBC database. To compare the trend across loan sizes, we take a logarithm for the number of loan disbursements and we adjusted the numbers of all loan sizes to zero in March 2017.

Figure 8: Changes in Average Size of Loans Per Loan Account

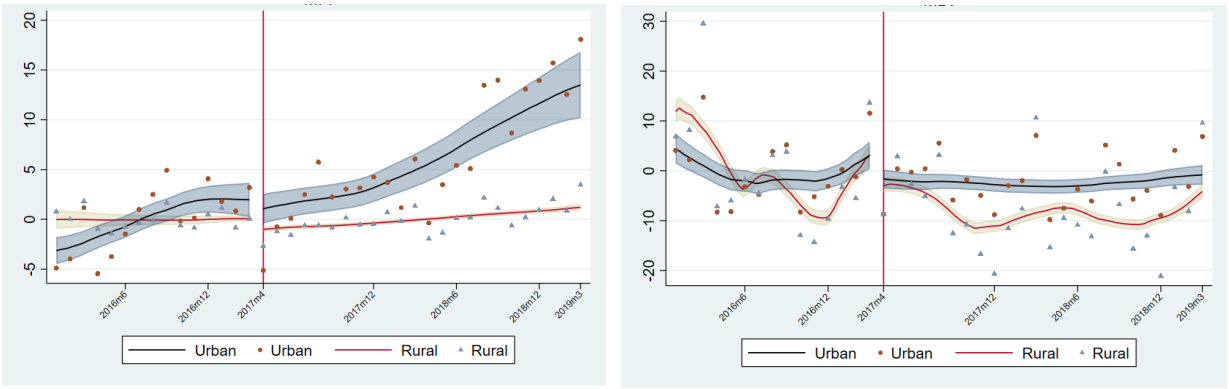
Non-MDI MDI



Source: Authors' calculations using the CBC database. To compare the trend between urban and rural areas, the variables in the graph are adjusted with the average value before the policy was implemented.

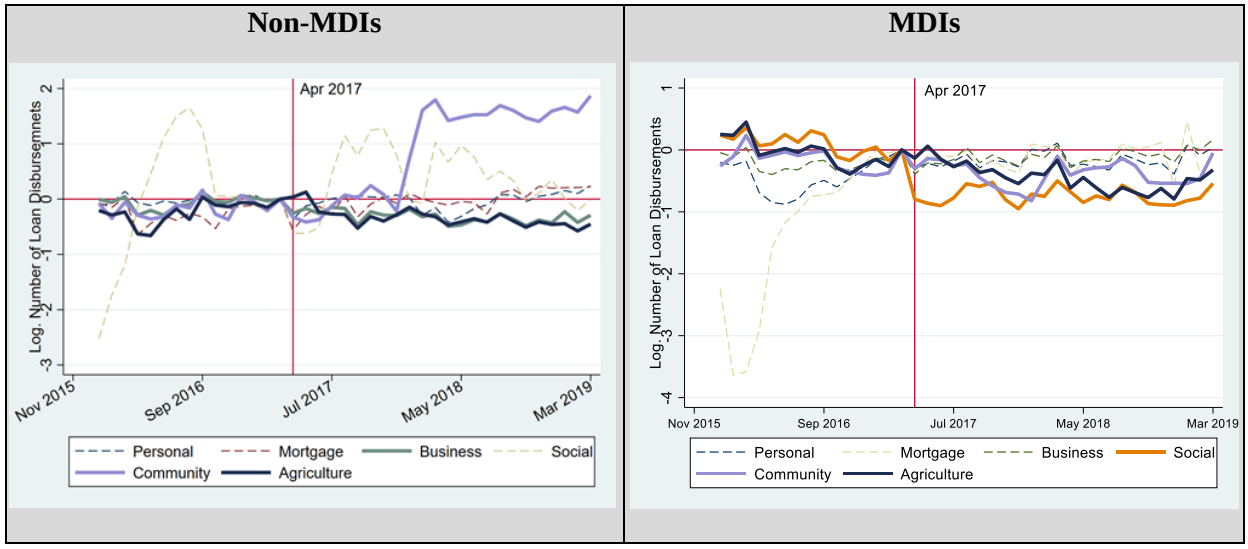
Figure 9: Changes in Number of Loan Disbursements per Commune

Non-MDI MDI



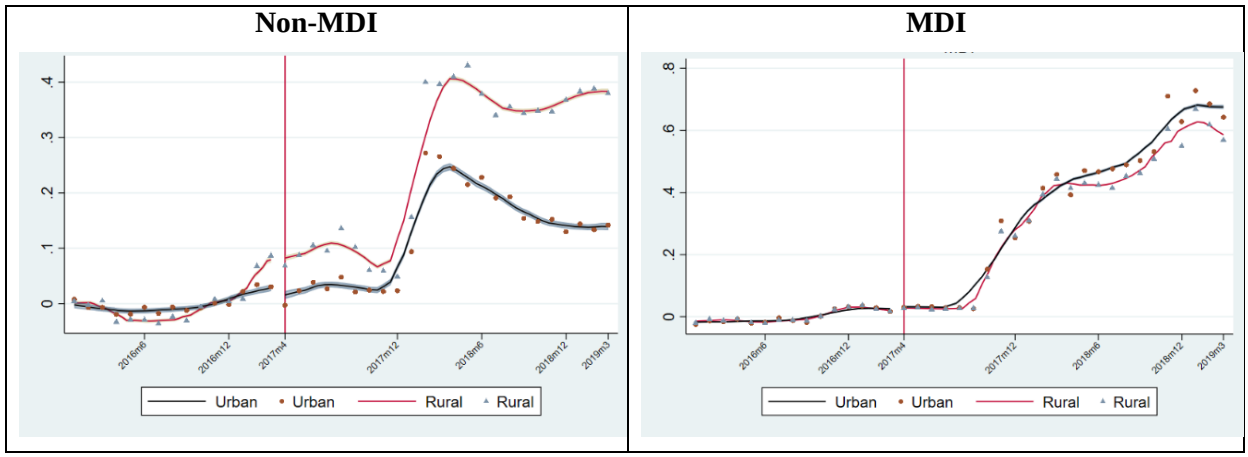
Source: Authors' calculations using the CBC database. To compare the trend between urban and rural areas, the variables in the graph are adjusted with the average value before the policy was implemented.

Figure 10: Trend in Total Number of Disbursed Loans by Loan Products



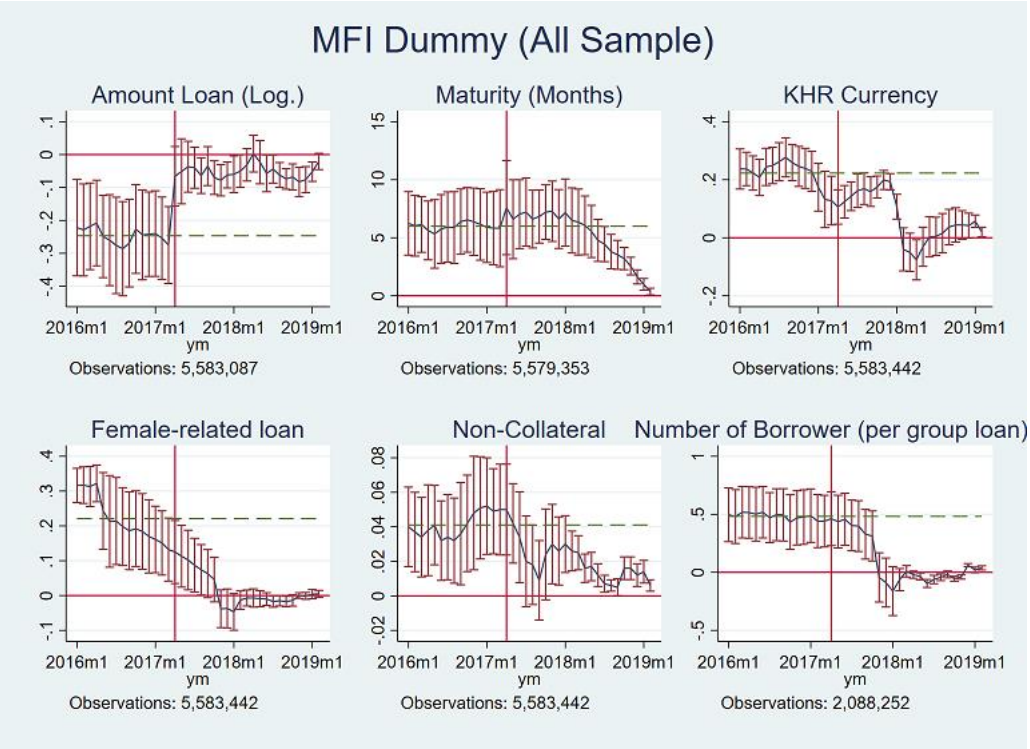
Source: Authors' calculations using the CBC database. To compare the trend across loan types, we took a logarithm for the number of loan disbursements and adjusted the numbers of all loan types at zero in March 2017.

Figure 11: Number of Borrowers per Loan Account



Source: Authors' calculations using the CBC database. We excluded loans of more than USD 10,000. Variables are adjusted by subtracting the average before the interest rate cap policy in order to compare the trend between rural and urban areas.

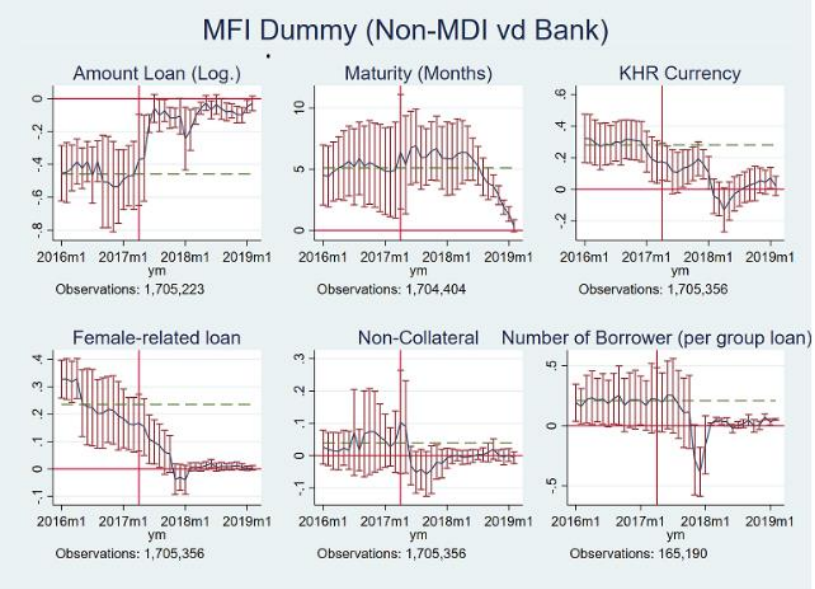
Figure 12: Estimated Coefficients of Interaction Terms of MFI Dummies and Time Dummies (β_t)



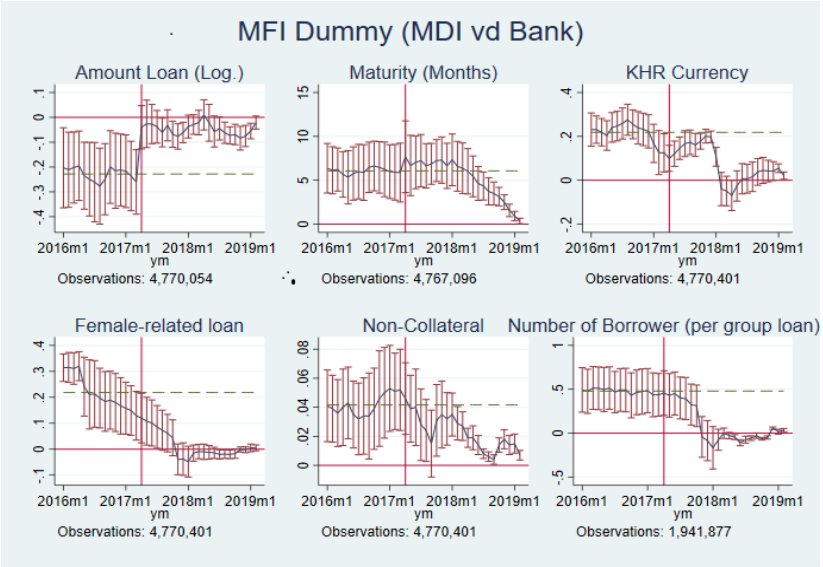
Note: This figure shows the estimated coefficients of interaction terms of MFI dummies and time dummies (β_t) in Equation 1. The dashed line represents the average of the estimated coefficient (β_t) before 2017M4. We conducted the fixed-effect estimation with clustered robust standard errors at firm level. The 5% confidence interval is shown in the figures. The sample of business loans, agricultural loans, and community loans is used for the estimation. We also excluded from the sample any loan that was higher than USD 5,000.

Figure 13: Estimation with Sub-Sample of "MDI vs Bank" and "Non-MDI vs Bank"

(a) Non-MDI vs Bank

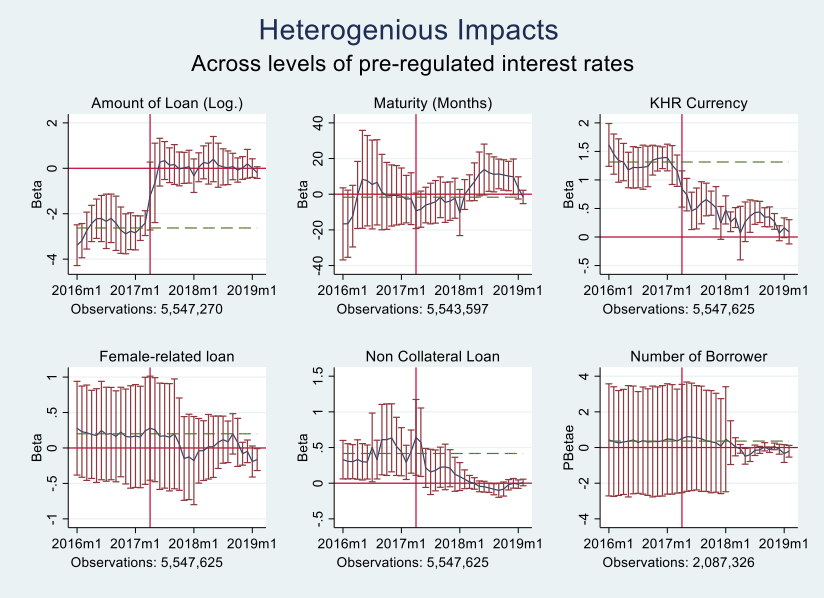


(b) MDI vs Bank



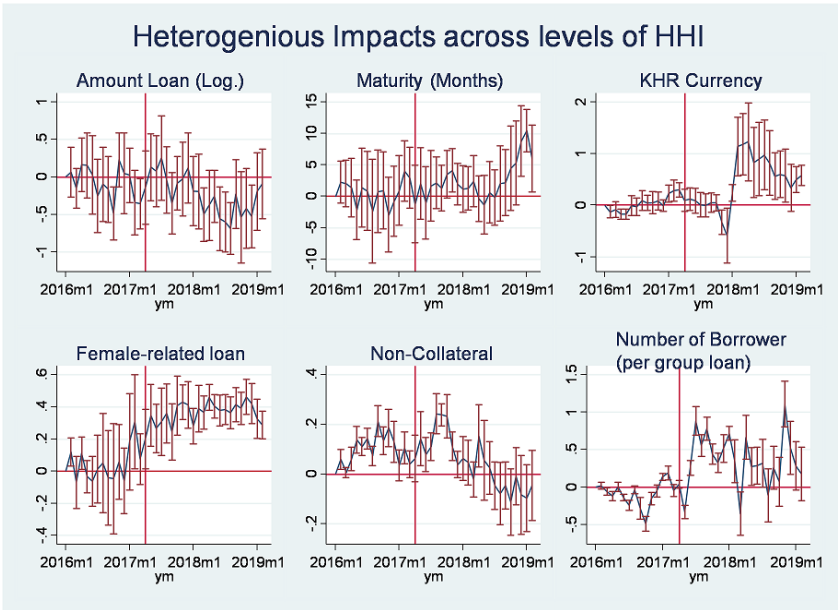
Note: This figure shows the estimated coefficients of interaction terms of MFI dummies and time dummies (β_t) in Equation 1. Using the data from the CBC database, we conducted the fixed-effect estimation with clustered robust standard errors at firm-level. The 5% confidence interval is shown in the figures. The sample of business loans, agricultural loans, and community loans is used for the estimation. We also excluded from the sample any loan higher than USD 5,000.

Figure 14: Estimated Coefficients of the Triplet Interaction Term of Pre-regulated Interest Rate



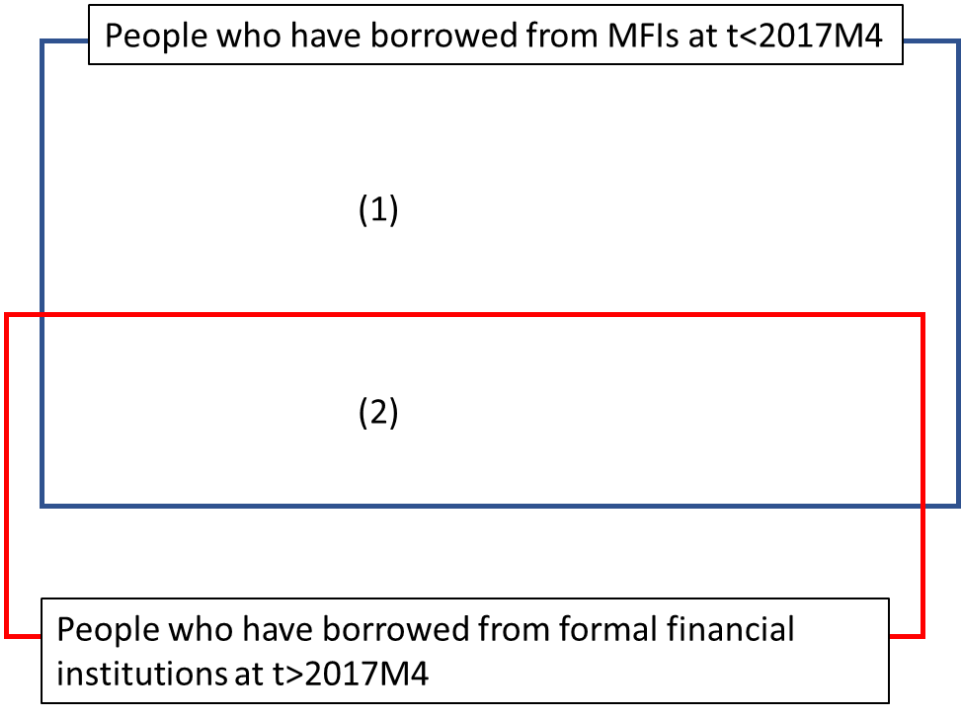
Note: This figure shows the estimated coefficients of the interaction terms of levels of pre-regulated interest rates, MFI dummies, and time dummies (β_{2t}) in Equation 2. Using the data from the CBC database, we conducted the fixed-effect estimation with clustered robust standard errors at firm level. The 5% confidence interval is shown in the figures. The sample of business loans, agricultural loans, and community loans is used for the estimation. We also excluded from the sample any loan that was higher than USD 5,000.

Figure 15: Estimated Coefficients of the Triplet Interaction Term of HHI



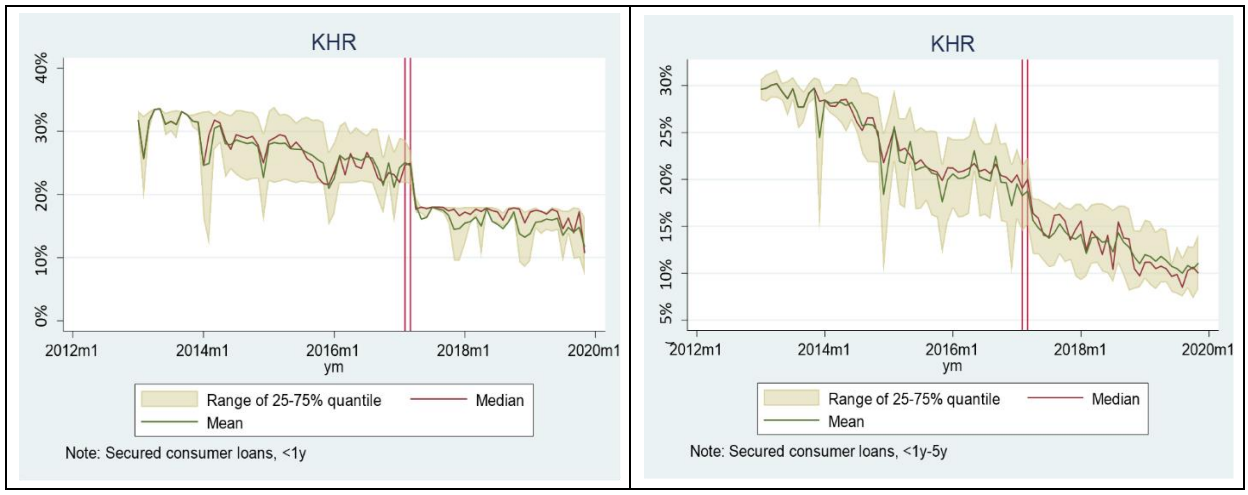
Note: This figure shows the estimated coefficients of the interaction terms of HHIs, MFI dummies, and time dummies (β_{2t}) in Equation 3. Using the data from the CBC database, we conducted the fixed-effect estimation with clustered robust standard errors at firm level. The 5% confidence interval is shown in the figures. The sample of business loans, agricultural loans, and community loans is used for the estimation. We also excluded loans that were higher than USD 5,000 from the sample.

Figure 16: The Segmentation of the Sample to be Analyzed



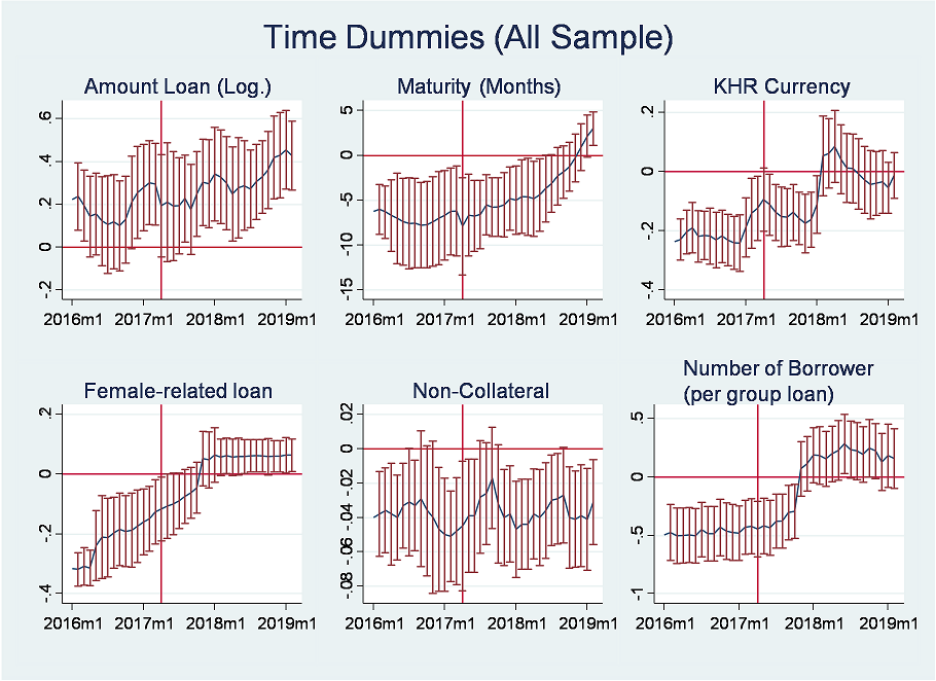
Note: This figure illustrates the segment of households we analyzed. Our analysis compared two segments of the sample: (1) people who borrowed from MFIs before 2017M4 but did not borrow from any formal financial institutions after 2017M4, and (2) people who borrowed from formal financial institutions before 2017M4 and also borrowed from formal financial institutions after 2017M4.

Figure 17: Interest Rates of Commercial Banks on Consumer Loans



Source: Author's calculation using the data provided by the National Bank of Cambodia. The figures show the average and median interest rates on KHR-secured consumer loans of a maturity of less than 1 year and 1-5 years, respectively.

Figure 18: Estimated Time Effects for Commercial Bank Loans



Note: This figure shows the estimated coefficients of time dummies **(β_t)** in Equation 3. The sample is limited to commercial bank loans from the CBC database. We conducted the fixed-effect estimation with clustered robust standard errors at firm level. The 5% confidence interval is shown in the figures. The sample of business loans, agricultural loans, and community loans is used for the estimation. We also excluded from the sample any loan that was higher than USD 5,000.

Appendix Table 1: Definition of Loan Products

Type	Definition
Personal Loan	Loans for motorbikes, durable goods, and healthcare etc.
Mortgage Loan	Loans for housing, the purchase of land, etc.
Business Loan	Loans for working capital, business investment, etc.
Social Loan	Loans for emergency purposes, green energy, etc.
Credit Card Loan	Credit card loans.
Institutional Loans	Loans to rural credit operators.
Community Loans	Loans for group lending, village banking, etc.
Agriculture Loans	Loans for agricultural purposes.

Appendix Table 2: Variables Used in Regression Analysis

Characters (X)	Definition
Bank Characteristics	
$InterestRate_{j,2016}$	Pre-regulated interest rates of MFIs in 2016 (%). The variable is calculated as the total interest expense in 2016 divided by outstanding loans at the end of 2016.
Region Characteristics	
$Urban\ Dummy$	A dummy variable to take the value one if the commune k is a capital of a province or located in the Phnom Penh Province.
Loan Characteristics	
KHR Currency Dummy	A dummy variable to take the value one if a loan is denominated in KHR.
Non-Collateral Loan Dummy	A dummy variable to take the value one if a loan is unsecured.
Female-Related Loan Dummy	A dummy variable to take the value one if a female borrower is involved in a loan account.
Group-Lending Dummy	A dummy variable to take the value one if a loan is a group-lending loan.
Joint-Account Dummy	A dummy variable to take the value one if a loan is a joint account loan.
Long-Term Loan Dummy	A dummy variable to take the value one if a loan has a maturity of more than one year.

Appendix Table 3: Descriptive Statistics

Variable	Observations	Mean	Std. Dev.
Log. Amount of Loans	4,064,239	1254.75	1218.99
Maturity	4,060,389	17.70	9.48
KHR Currency	4,064,239	0.71	0.45
Female-related	4,064,239	0.85	0.36
Non-Collateral	4,064,239	0.05	0.21
Group Lending	4,064,239	0.48	0.50
Joint Account Lending	4,064,239	0.19	0.39
Number of Borrowers per loan	4,064,239	1.24	0.45
Interest rate	4,053,652	0.22	0.11

Note: The table shows the descriptive statistics of the sample used for the analysis in Section 5. The sample encompasses loan disbursements in the form of agricultural loans, business loans, and community loans. All loans were for na amount less than USD 5,000.

Appendix Table 4: Descriptive Statistics

	Observations	Mean	Standard Diviation
Number of Borrowings before 2017M4	1,208,591	1.40	0.73
Average Amount Loans (Log.) before 2017M4	1,208,497	6.56	0.87
Average Maturity (Monthly) before 2017M4	1,208,591	14.63	5.04
Dummy of Female Borrowers before 2017M4	1,208,577	0.74	0.44
Dummy of Having KHR Loan before 2017M4	1,208,591	0.73	0.44
Dummy of Having Individual Loan before 2017M4	1,208,591	0.44	0.50
Dummy of Having Group Lending Loan before 2017M4	1,208,591	0.67	0.47
Dummy of Having Non-Collateral Loan before 2017M4	1,208,591	0.06	0.25
Dummy of Having Business Loan before 2017M4	1,208,591	0.32	0.47
Dummy of Having Community Loan before 2017M4	1,208,591	0.42	0.49

Note: The table shows the descriptive statistics of the sample used for the analysis in Section 6. The sample includes borrowers who had an agricultural loan, business loan, or a community loan of less than USD 5,000 before 2017M4.

Appendix Table 5: Estimation of Retaining Access to Formal Financial Institutions

	Only MDI	Only non-MDI	Only Banks
Number of borrowing experiences	0.011***	0.005	0.011***
	(0.002)	(0.004)	(0.003)
Average size of loans (Log)	0.067***	0.061***	0.047***
	(0.002)	(0.004)	(0.002)
Maturity (Monthly)	0.000	0.000	-0.002***
	(0.000)	(0.001)	(0.000)
Female Borrower Dummy	0.030***	0.028***	0.008***
	(0.002)	(0.004)	(0.002)
KHR Currency Dummy	0.040***	0.026***	0.016***
	(0.004)	(0.006)	(0.003)
Joint Lending	0.026***	0.053***	0.026***
	(0.002)	(0.005)	(0.003)
Group Lending	-0.006**	0.022***	0.042***
	(0.003)	(0.006)	(0.003)
Non-Collateral Loans	0.001	-0.020***	-0.080***
	(0.004)	(0.005)	(0.008)
Urban area dummy	-0.024***	-0.021**	-0.029***
	(0.005)	(0.009)	(0.005)
Product Dummies	Yes	Yes	Yes
Time Dummies	Yes	Yes	Yes
Commune Dummies	No	No	No
Constant	0.049***	0.082***	0.267***
	(0.015)	(0.027)	(0.014)
Adjusted R-Squred	0.074	0.083	0.044
Observations	923083	93625	266939

Note: The dependent variable is a dummy of whether a person with debts from MFIs retained access to formal financial institutions after the introduction of the IR cap. We perform an OLS estimation with cluster-robust standard errors at commune level. The sample is reduced to agricultural loans, business loans, and community loans, and the sample is also excluded if loan size is more than USD 5,000.

Abstract (in Japanese)

要約

カンボジアでは、2017 年 4 月にマイクロファイナンス機関（MFI）の貸出に上限金利政策が新たに実施された。政策実施前は貸出金利の制限はなく、MFI の多くは 18%以上で貸出を行っていた。そのため、この金利キャップ政策によって MFI のアウトリーチに悪影響が出ることが懸念される。本稿では、カンボジアの信用情報局のデータベースにある詳細な金融機関の貸出データを利用して、上限金利規制が MFI に与える影響を調査した。分析では、2016 年 1 月から 2019 年 3 月までの期間に貸出が行われた、商業銀行、専門銀行、マイクロファイナンス機関を含むすべての金融機関の 6,897,168 件の個人ローンの情報を使用した。その結果、マイクロファイナンス機関にとって小口融資や無担保融資は一般的に融資コストが高いことから、マイクロファイナンス機関に金利キャップ政策が導入された後、1 件あたりの平均融資額と担保を要求する確率がともに有意に上がることがわかった。さらに、上限金利規制導入前の小口ローンの借り手は、規制導入後はフォーマルな金融市場から排除される確率が高いことがわかった。これらの結果は、上限金利規制が金融システムのアウトリーチに影響を与えていたことを示唆している。

キーワード: 上限金利規制、マイクロファイナンス、カンボジア、規制、銀行貸出

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