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Interest rate caps in an economy with formal and informal credit markets

Graduate Institute of International and Development Studies Working Paper, No. HEIDWP16-2022

Provided in Cooperation with:
International Economics Section, The Graduate Institute of International and Development Studies

Suggested Citation: Pozo, Jorge (2022) : Interest rate caps in an economy with formal and informal credit markets, Graduate Institute of International and Development Studies Working Paper, No. HEIDWP16-2022, Graduate Institute of International and Development Studies, Geneva

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Graduate Institute of International and Development Studies

International Economics Department

Working Paper Series

Working Paper No. HEIDWP16-2022

Interest Rate Caps in an Economy with Formal and Informal Credit Markets

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July 2022

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BCC Bilateral Assistance & Capacity Building for Central Banks

Interest Rate Caps in an Economy with Formal and Informal Credit Markets*

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June, 2022

Abstract

In this work, we aim to study the implications of the interest rate cap in an emerging economy. To do so we develop a two-period banking model with entrepreneurs that undertake risky projects and with formal and informal lenders. Entrepreneurs are heterogeneous in their level of net worth. We find that a cap on the lending interest rate excludes entrepreneurs with a low level of net worth, which in turn increases the participation of the informal credit market, but also might reduce bank markups increasing entrepreneurs' welfare. As a result, our model implies that the lower the market power of banks, the smaller the likelihood that the cap might have some positive impact on aggregate credit and investment.

Keywords: Interest rate cap; Informal credit market; monopoly banks.
JEL Classification: E5; G21; G23.

*The author is very thankful to Professor Jean-Charles Rochet for the academic supervision of this paper. The authors also want to thank Professor Cédric Tille and to participants of a seminar at the Graduate Institute of International and Development Studies (IHEID) for helpful comments. This research took place through the Coaching Program of the Bilateral Assistance and Capacity Building for Central Banks (BCC), financed by SECO, and the Graduate Institute in Geneva. The views expressed in this paper are solely those of the author and do not necessarily reflect those of the Central Reserve Bank of Peru.

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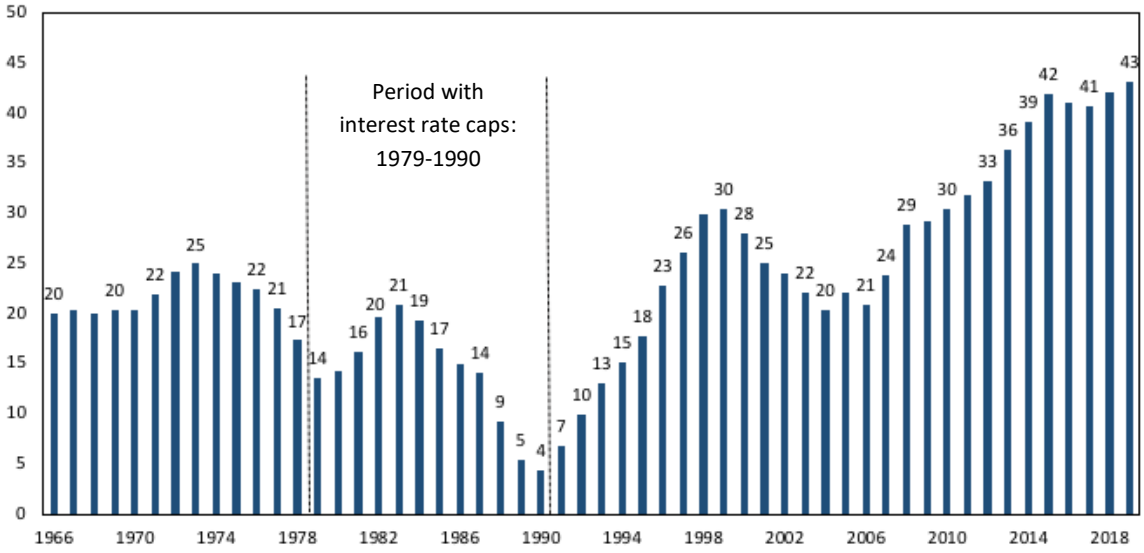
1 Introduction

The use of interest caps is widespread (see Ferrari et al., 2018 and Maimbo, 2014[1]). In general, the purpose of the caps is to reduce very high interest rates and hence to increase the access to loans for those with less chance. However, theoretical and empirical literature suggest that caps can be very harmful precisely for those whom they are intended to favor.[2] According to the next figure, it seems that controls on interest rates in Peru in the 80s accentuated the credit contraction.

Figure 1: *Private Credit to GDP (%)*



Source: Figure 1 in Pozo (2020).

In Peru, after a large debate on whether to introduce caps on the lending rates, in March 2021 it was promulgated the Law No 31443. It establishes that the Reserve Central Bank of Peru (BCRP) should state a cap on the lending rates of new personal loans, personal loans of small amounts (lower than 2 UIT[3]), and new loans to small and micro-sized firms in the financial system. By the end of April 2021, the BCRP set the interest cap as two times the average interest rate of personal loans in the financial system.[4]

In December 2020 loans to small and micro-sized firms represent 21.5% of total loans to firms in the financial system. In addition, 52% of these loans were issued by banks, while 48% by non-banks. And only 34% of these loans are issued in the metropolitan

[1]Maimbo (2014) finds at least 76 countries around the world currently use some form of interest rate caps on loans.

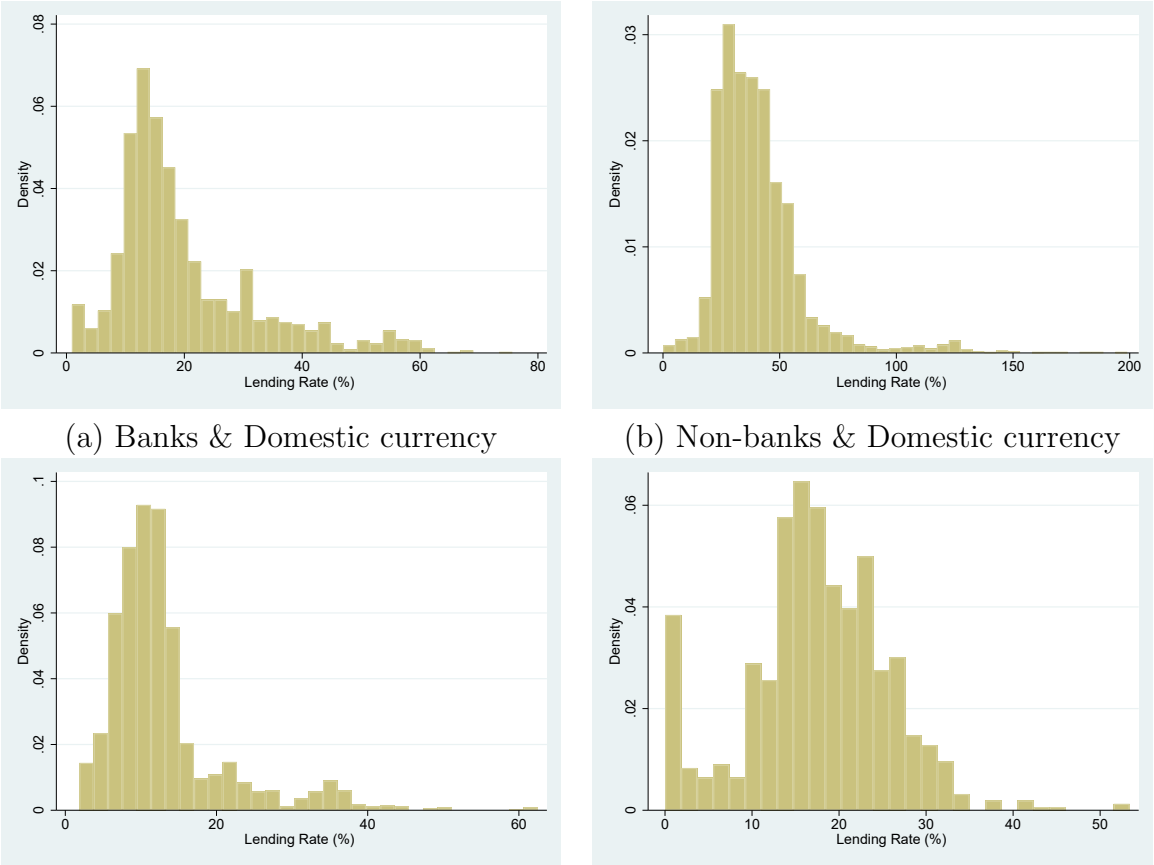
[2]See Pozo (2020) for a survey of this literature.

[3]UIT is a measure in "soles" for tax purposes, 1 UIT = S/ 4 150

[4]The interest rate cap is computed semiannually considering the interest rates of personal loans between two and seven months before its validity.

area of Lima. So, an important fraction of these loans is issued by small-sized financial institutions outside the main city. Figure 2 shows the distribution of lending interest rates reported by banks and non-bank financial institutions in domestic and foreign currency.[5] It is more likely that the cap starts binding on loans issued by non-bank financial institutions, since they present the higher lending rates, at least in domestic currency.

Figure 2: *Histograms of the lending interest rate of loans to small and micro-sized firms*



(a) Banks & Domestic currency

(b) Non-banks & Domestic currency

(c) Banks & Foreign currency

(d) Non-banks & Foreign currency

Source: Superintendency of Banking, Insurance and AFP (SBS). Own elaboration. The lending interest rate is the average interest rate of the operations in the last 30 business days reported by firms' size (small and micro-sized firms) and by the loan term. We use end-of-the-month information. The time period analyzed spans from January 2019 to December 2020.

As a result, it is of crucial interest to understand and measure the impact of this cap on the formal and informal credit market and welfare. In that line, the main research question is: what are the implications of the interest rate cap on real and financial variables and social welfare in the Peruvian economy? We are not aware of a theoret-

[5]Financial institutions report the average interest rates of the operations in the last 30 business days by firms' size (corporate, big, mid, small and micro-sized firms) and loan term. Non-bank financial institutions: *empresas financieras*, municipal credit and saving institutions (CMACs by its Spanish acronym), rural credit and savings institutions (CRACs by its Spanish acronym) and small business and microenterprises development institutions (EDPYMEs by its Spanish acronym).

ical framework to assess caps' impact in emerging economies with formal and informal lenders. In this paper, we aim to provide a theoretical framework to qualitatively and quantitatively assess the impact of the interest rate caps on aggregate credit and investment, the lending interest rates, and economic welfare. For example, we would like to see if caps exclude borrowers from the formal credit markets and move these to the informal credit market with higher interest rates and hence reducing welfare. In the same line, it would be interesting to see if caps are reducing or increasing economic activity.

To do so, we build up a theoretical static banking model with formal and informal monopoly lenders, and entrepreneurs. This is to capture the pricing power that might exist in some credit markets, where there are few creditors. Entrepreneurs demand loans to undertake risky projects of fixed size and are heterogeneous on their level of net worth that works as collateral. Entrepreneurs (borrowers) in the credit market are small or micro-sized firms. So, we focus on caps to the interest rates of loans to small-sized and micro-sized firms. Only formal lenders are subject to the interest rate cap. Since the project size is fixed, we focus on the extensive margin of the impact of caps on credit and investments.

We find that the level of collateral of entrepreneurs diminishes the risk-premium of the lending interest rate charged to them. In addition, in a monopolistic credit market, the cap might reduce the markups of banks and increase entrepreneurs' welfare, but at the same time excludes entrepreneurs with low collateral levels and increases the size of the informal credit market. While the former might increase investment, the latter reduces aggregate credit and investment. Hence, the cap raises a trade-off, where the monopoly power degree in the formal credit market seems crucial to determine the possible impact on aggregate credit and investment. In particular, the lower the market power of banks, the smaller the likelihood that the cap might have some positive impact on aggregate credit and investments.

The remainder of this paper is partitioned as follows. Section 2 presents the literature review. Section 3 develops the baseline model. In section 4 we incorporate the interest rate cap and the informal lender. Finally, section 6 concludes.

2 Literature review

This work is related to the literature on modeling the informal credit market, as in Antunes and Cavalcanti (2007), Madestam (2014) and Batini et al. (2010). Antunes and Cavalcanti (2007) develop a dynamic general equilibrium model to assess how much of the variation of the informal sector is explained by entry barriers (regulation costs) and credit market imperfections (contract enforcement). They find that the differences in the size of the informal sector between the US and Mediterranean Europe could be explained

by the regulation costs of financial contracts; however, for an emerging economy as Peru, the size of the informal sector can be equally explained by the regulation costs and the contract enforcement of financial contracts. They model informality in the production sector, i.e., agents decide to be a worker of a formal o informal entrepreneur. In contrast, we focus on the informality in the credit market.

Madestam (2014) develops a theoretical model with formal and informal finance in an underdeveloped credit market. In its model, formal banks have access to unlimited funds but are unable to control the use of credit and informal lenders can prevent non-diligent behavior but often lack the needed capital. The model suggests that weak legal institutions might increase the prevalence of informal finance. Its framework does not study the role of interest rate caps. Finally, Batini et al. (2010) explore empirical and theoretical findings regarding the informal credit market, particularly important in emerging markets. The explanation they find in the literature regarding the higher interest rate in the informal market is the imperfect enforcement and that banks (formal lenders) rely heavily on collateral. So, firms lacking collateral borrow from informal lenders. Indeed, in this paper the heterogeneity of borrowers comes from the collateral size and hence those with low collateral end up borrowing from the informal lender.

For Peru, Guirkinger (2008) finds in econometric analysis, with data collected in the rural coastal area of the department of Peru for 499 farmers in 1997 and 2003, that informal lenders serve households excluded from the formal credit market but also households that prefer informal loans due to lower transaction costs or lower risk, driven by proximity and economies scope.

This research is also related to the literature on modeling interest rate caps. In a theoretical model for emerging economies, Joaquim and Sandri (2020) state that interest rate caps to only a fraction of loans generates bad credit allocations. In particular, caps might increase inefficiency and reinforce banks' market power (by forcing less profitable banks to exit). However, they do not model informal lenders. Wang (2021) estimates a dynamic equilibrium model and finds heterogeneous effects on households after implementing a policy of a low fixed borrowing rate and low fixed borrowing costs. More productive households benefit, but less productive lost in terms of welfare.

In general, policy literature highlights the undesired effects of the interest rate caps on developed and emerging economies.[6] The main undesired effects are the lower access to formal credit and the increase of the informal credit (see, e.g., Ferrari et al., 2018; Laeven, 2003; Madeira, 2019), the increase of costs associated with the loans (see, e.g., Melzer and Schroeder, 2017; Bodenhorn, 2007), and credit reallocation that could be inefficient (see, e.g., Safavian and Zia, 2018; Hurtado, 2016). In a recent paper, Aiba et al. (2021), using loan-level data find that the average loan size and the probability of

[6]See Pozo (2020) for a detailed literature review on this point.

requiring collateral increased after the interest rate cap in Cambodia in April 2017;[7] and that borrowers of small-sized loans and non-collateral loans were likely to be excluded after the cap.

As a result, this paper aims to fill the gap existing between the literature on informal credit market and interest rate caps by considering these two features and the same theoretical framework, and thus aims to contribute to the literature by focusing on the impact of interest rate caps on real and financial variables.

3 Baseline Model

We develop a static banking model with entrepreneurs, formal and informal lenders, and depositors. We assume all agents are risk-neutral. Entrepreneurs demand bank loans to invest in risky projects. They have limited liability and are heterogeneous in their level of net worth. For a representative sample of firms in Peru, figure 7 suggests that the capital to asset ratio is heterogeneous across all firms and also across small and micro-sized firms. As expected the group of small and micro-sized firms dependent more on their own resources.[8]

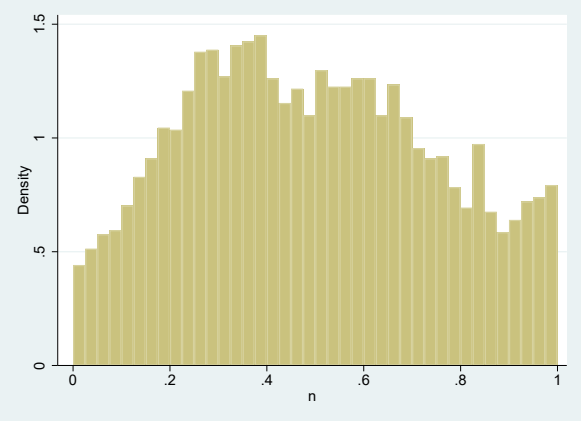
In the model, formal lenders (banks) capture deposits from households, and the informal lender uses its resources. We assume both lenders operate in monopolistic credit markets. For simplicity, we assume that monopoly banks extract the entire surplus from borrowers. Only formal loans are subject to the interest rate cap. The informal lender does not require collateral and informal loans are more expensive than formal loans.[9] In this baseline model, we start without the interest rate cap and the informal lender.

[7] A cap of 18% was imposed on microfinance institutions to reduce the debt burden on consumers.

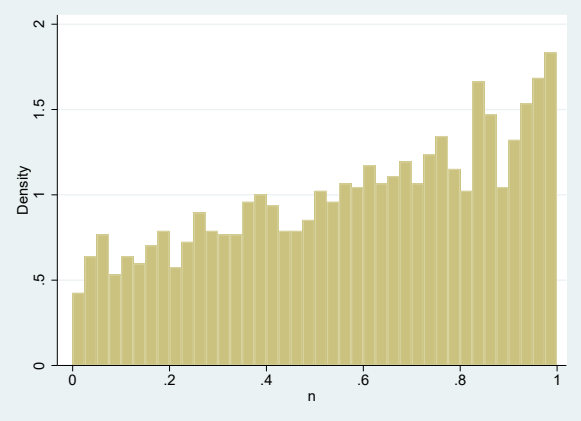
[8] The information is taken from the Annual Economic Survey. This survey contains 2018 information of financial statements of a firm representative sample in Peru. The sampling frame is 87,240 firms. It excludes firms with zero sales, firms in liquidation, state companies, firms with sales higher or equal 150 UIT, agricultural firms, public education companies and mining firms. The size of the sample is 13 869 firms.

[9] In a survey for 12 informal lenders and 18 entrepreneurs in the local food market performed in 2013, ASBANC (2013), find that the informal lending rate was clearly higher. Similarly, IPE (2012) reports higher interest rate of informal loans in a survey of 502 and 504 clients of informal and formal credit markets, respectively, in 2012, in Arequipa, Trujillo and Lima.

Figure 3: *Histogram of capital to asset ratios of firms*



(a) All firms



(b) Small and micro-sized firms

Source: 2019 Annual Economic Survey. Number of observations of all firms: 4 438. Number of information of small and micro-sized firms: 1 874. Small-sized firms: Sales smaller than S/ 20 000. Small-sized firms: Sales between S/ 20 000 and S/ 300 000.

Risky projects: Projects are risky and have the same size of one. These are fully funded with loans. In case of success the gross payoff of the project is $A > 0$ with probability p, otherwise, the payoff is 0 with probability $1 - p$, where $0 < p < 1$. For simplicity, we assume that A and p are the same for all projects and that their payoffs are perfectly correlated. Furthermore, we assume $pA > 1$.

Entrepreneurs: There is a continuum of entrepreneurs of measure one. Entrepreneur holds net worth invested in safe assets, n, that, for simplicity, give a gross payoff of 1. Recall entrepreneurs are heterogeneous on n.

Let's $R(n)$ be the gross lending interest rate charged by banks to entrepreneurs. We assume n is not very large, so if the project fails, the entrepreneur defaults since it has limited liability, i.e., we assume:

$$R(n) > n.$$

As a result, entrepreneurs default with probability $1-p$. Then, the expected entrepreneur profits yield,

$$p(A - R(n) + n).$$

Due to the market power of the bank, formal lender charges the maximum repayment $R(n)$ that can be accepted by an entrepreneur with collateral n, i.e., the lending interest rate $R(n)$ is solved in:

$$p(A - R(n) + n) = n, \tag{1}$$

where the left-hand side is the expected wealth when the entrepreneur invests in the risky project, which is the success probability times the net payoff, and the right-hand side is the wealth when no project is undertaken.

Since at the lending rate $R(n)$, entrepreneurs are indifferent about undertaking the project or not, we assume that entrepreneurs receive a private benefit for undertaking the project, so the project is undertaken.

From (1) we solve for the gross lending interest rate:

$$R(n) = A - \frac{1-p}{p}n. \tag{2}$$

Lending interest rate $R(n)$ is heterogeneous and decreasing in n. We can formulate two interpretations for equation (2): The higher the n, the more entrepreneur's skin is in the game, and so they are going to accept a lower lending rate from banks, so they undertake the project. And second interpretation is as follows: The higher the n, the higher the collateral in case of entrepreneur default, which leads banks to claim for a lower (non-default) lending interest rate, $R(n)$.

Formal lenders (banks): We have monopoly banks that can charge the maximum lending rate whenever it is possible. So, banks get all the surplus. Bank loans are fully funded with households' deposits. The supply of deposits is perfectly elastic at a deposit interest rate normalized to one. Bank expected profits are:

$$\pi^F(n) = pR(n) + (1-p)(n-\gamma) - 1, \tag{3}$$

where $\gamma > 0$ is the liquidation cost. We assume,

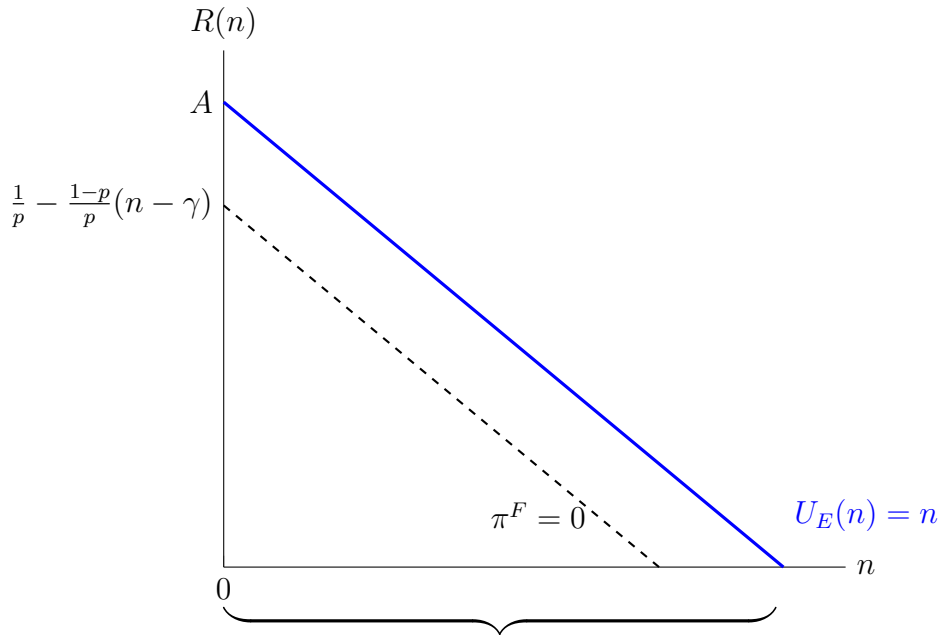
$$pA > 1 + (1-p)\gamma, \tag{4}$$

and hence $\pi^F > 0$ and so all entrepreneurs borrow from formal lenders. In other words, condition (4) ensures that banks can lend to all entrepreneurs at the lending rate given by equation (2) and receive non-negative profits.

Equilibrium: All entrepreneurs borrow from the formal credit market and undertake the projects. The expected utility of entrepreneur yields $U_E(n) = n$ and banks expected profits are $pA - (1-p)\gamma - 1$. So, bank profits are independent of the distribution of borrower net worth.

Indeed, figure 4 illustrates the lending rate set by monopoly banks to entrepreneurs with different n (solid blue line) and the lending rate that makes bank profits zero (dashed black line). In the latter case, the gross lending interest rate is $\frac{1}{p} - \frac{1-p}{p}(n-\gamma)$. Due to (4) the lending interest rate set by monopoly banks is higher than interest rates in a competitive market.

Figure 4: *Lending Interest Rate and Entrepreneur Net worth*



$U_E(n) = n$: Setting the expected profits of entrepreneurs equals n. The dashed black line is the lending rate that makes expected bank profits zero, i.e., this should be the rate in a perfectly competitive credit market: $R(n)$ such that $\pi^F = 0$.

4 Interest Rate Cap and Informal Lender

Interest rate caps: Only formal loans are subject to the lending interest rate cap, R^c. The cap is the same for all loans and hence independent of n. Then, banks charge to entrepreneurs the following lending rate:

$$min\left\{R^c, R(n)\right\}.$$

Recall that without the cap, banks always get positive expected profits and thus lend to all entrepreneurs. With the cap banks might obtain negative expected profits if desire to issue loans to entrepreneurs with a low level of net worth, n. So, banks exclude borrowers for which the expected profits are lower than zero.

Notice that when interest rate cap binds, bank profits, equation (7), yield:

$$\pi^F(n) = pR^c + (1-p)(n-\gamma) - 1, \tag{5}$$

Then, there is an n_1 such that $\pi^F(n_1) = 0$:

$$n_1 = \gamma + \frac{1 - pR^c}{1 - p}. \tag{6}$$

Thus, all entrepreneurs with $n < n_1$ are not going to receive any formal loan. This is, entrepreneurs with very small collateral that face very high lending rates are going to be excluded from the formal credit market since the bank will obtain negative expected profits from issuing loans to those entrepreneurs. In addition, the liquidation costs increase the number of entrepreneurs that are excluded from the formal credit market.

In addition, there is an n_2 such that the lending interest charged to banks and decreasing on n, equation (2), yields the cap level R^c, i.e.,

$$R(n_2) = R^c. \tag{7}$$

This leads to:

$$n_2 = \frac{p}{1 - p} \left[A - R^c\right]. \tag{8}$$

The cap binds for those rates higher than R^c or equivalently for those entrepreneurs with an n lower than n_2. Due to (4), $n_1 < n_2$. To sum up, the impact of the cap is heterogeneous across entrepreneurs due to their differences in net worth size. Entrepreneurs with

- $n < n_1$, are excluded from the formal credit market since banks no longer find it profitable to issue loans to them.
- $n_1 \leq n < n_2$, stay in the formal credit market. And since the cap bins, they are going to be charged a lower lending rate. These entrepreneurs get improved their welfare.
- $n_2 \leq n$, are not affected at all since the cap does not bind.

Thus, we identify a trade-off. On the one hand, the cap excludes some entrepreneurs from the credit market. Thus, this has a negative impact on aggregate investment and activity. This is the impact of the cap on the extensive margin.

On the other hand, it reduces the funding costs for some entrepreneurs. In aggregate, it increases the welfare of entrepreneurs and hence produces a more even distribution of utility. In a dynamic model, this might have a positive impact on entrepreneurs' solvency and allow them to get better credit conditions in the future. Furthermore, in a model with an endogenous size of projects (i.e., when the size of the project becomes a choice variable), the cap might also have an impact on the intensive margin. This is, for non-excluded entrepreneurs facing a binding cap (i.e., $n_1 \leq n < n_2$), the cap might raise incentives to invest due to the lower funding cost.

Informal Lender: Informal lender operates in a monopolistic informal credit market. Since this is not subject to the interest rate cap, it can charge a higher lending interest rate, $R^I > R^c$, to excluded entrepreneurs. Monopoly informal lender sets the maximum lending rate, R^I, which makes the expected profits of undertaking the project equal to the profits of not undertaking the project:

$$p(A - R^I + n) + (1 - p)n = n. \tag{9}$$

This results in:

$$R^I = A. \tag{10}$$

Clearly, the informal lending rate is higher than the formal rate, i.e., $R^I > R(n) = A - \frac{1-p}{p}n$. This is because if entrepreneurs default, they still stay with the collateral n, so informal lenders are not able to charge a higher lending rate (compared to formal lenders). Then, the positive expected profits of the informal lender are:

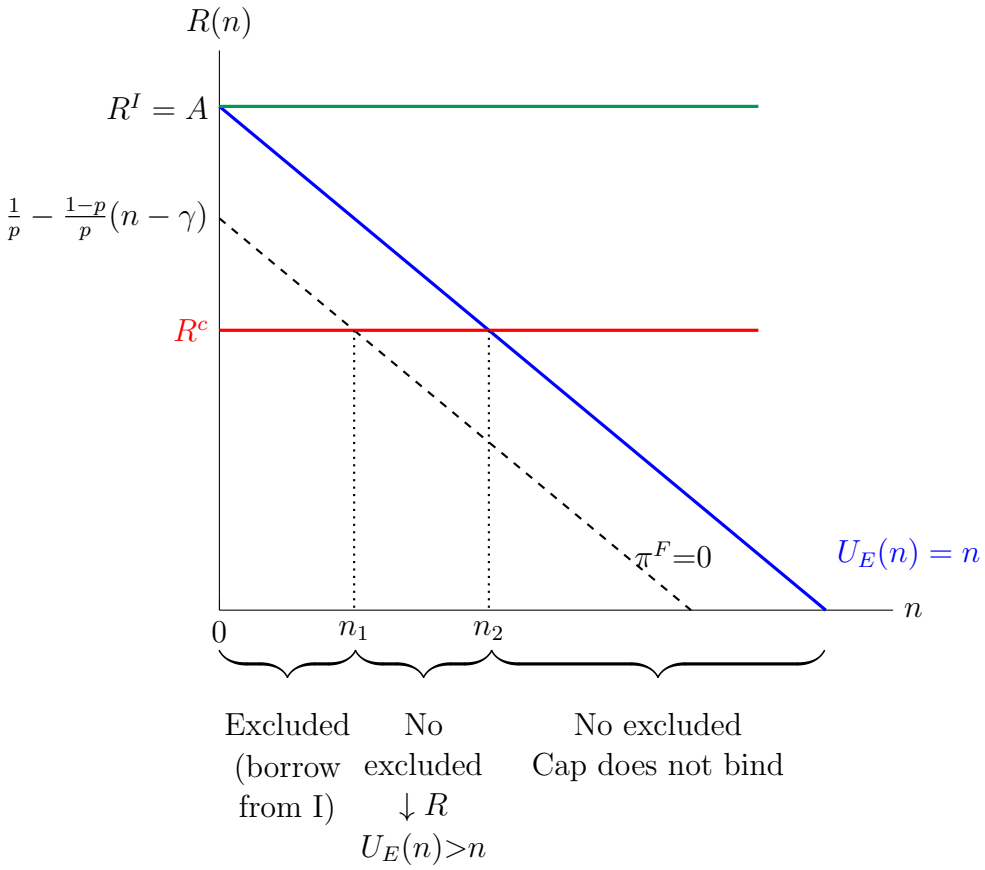
$$\pi^F(n) = pA - 1 > 0. \tag{11}$$

and hence higher than expected profits of banks. The entrepreneurs excluded from the formal credit market are going to borrow from the informal lender. With this, entrepreneurs with

- $n < n_1$, which are excluded from the formal credit market, will move to informal lenders. They still obtain an expected utility of $U_E(n) = n$.
- $n_1 \leq n < n_2$, stay in the formal credit market. And they still get an expected utility of $U_E(n) = p(A - R^c + n) > n$.
- $n_2 \leq n$, stay in the formal credit market. And they still have an expected utility of $U_E(n) = n$.

Figure 5 illustrates the impact of the cap and the informal lending on the access to the formal credit market. The solid red line illustrates the interest rate cap, while the solid green line is the lending rate of informal loans. As stated before, entrepreneurs with low net worth and hence with a high lending rate are excluded from the formal credit market and move to the informal credit market. And there are some entrepreneurs with an intermediate level of net worth that are not excluded from the formal credit market and are even positively affected by the cap since they will pay less for formal loans and will increase their utility.

Figure 5: *Entrepreneur Net Worth, Lending rate Cap and Informal Lender*



$U_E(n) = n$: Setting the expected profits of entrepreneurs equals n. The dashed black line is the lending rate that makes expected bank profits zero, i.e., this should be the rate in a perfectly competitive credit market: $R(n)$ such that $\pi^F = 0$. I: informal lender.

5 Extensions and discussions

5.1 Enforcement power of informal lender

Here, we assume that informal lender has a stronger power to enforce entrepreneur to repay the loan even if entrepreneur defaults. To capture this, we assume that entrepreneurs have no limited liability if they borrow from informal lenders. In that case, expected profits of entrepreneurs yield:

$$p(A - R^I + n) + (1-p)(n - R^I). \tag{12}$$

This time the maximum lending rate R^c that set informal lender is solved in:

$$p(A - R^I + n) + (1-p)(n - R^I) = n. \tag{13}$$

This leads to:

$$R^I = pA. \tag{14}$$

The new informal lending rate is smaller since informal lender can enforce entrepreneurs to repay even if they default. This implies that informal lender cannot charge a very high lending rate, otherwise, entrepreneurs will not undertake the project. Notice that if the cap is higher or lower than the new informal rate, excluded entrepreneurs borrow from the informal lender.

In this case of perfect enforcement of informal lenders, the informal lending rate could be lower than the formal interest rate. In the case of Peru, we observe that informal lending rates are clear higher (see, e.g., IPE, 2012; ASBANC, 2013). Even though informal lenders might have an unethical enforcement strategy, this is not necessarily what drives the spread between formal and informal interest rates.

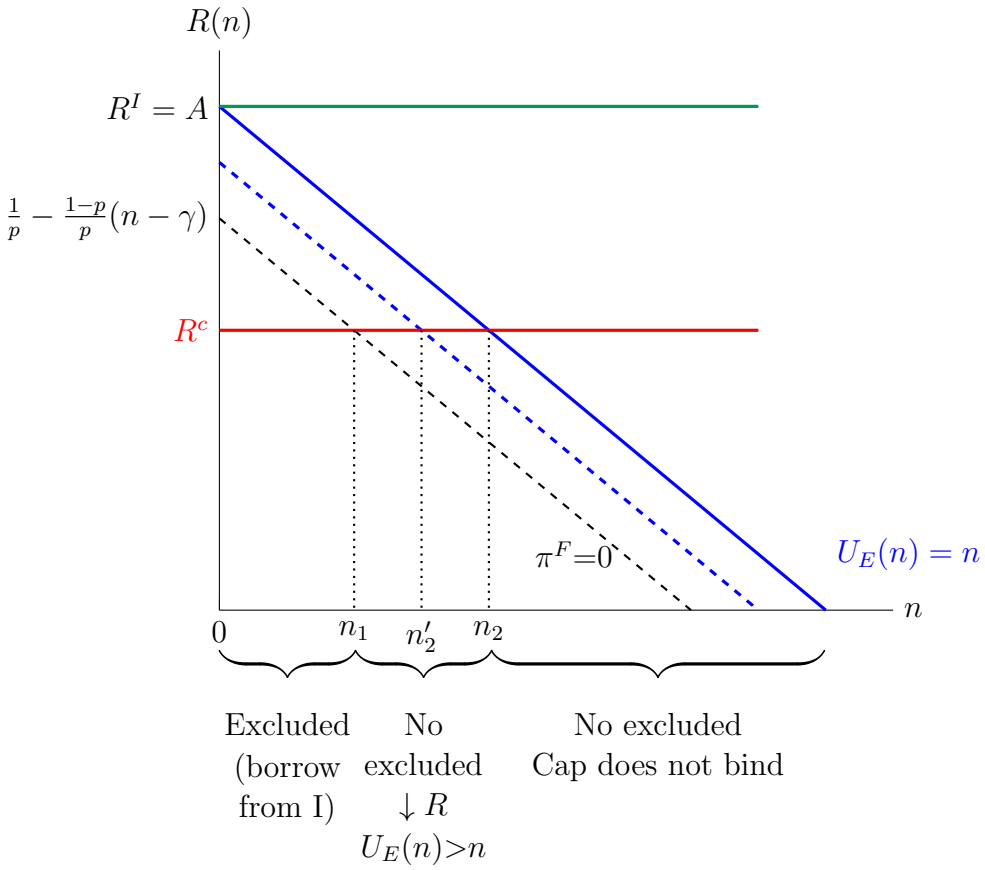
5.2 Monopoly power of lenders

The smaller the monopoly power of banks the smaller the lending interest rate $R(n)$ and then the cap is less binding. In particular:

- The same entrepreneurs are excluded. Monopoly power affects the expected profits of banks, but it does not affect the lending rate that makes entrepreneurs' profits zero (dashed black line in figure 6).
- Less lending interest rates are limited by the cap. Due to the smaller monopoly power, banks are less able to charge a higher lending interest rate (or a higher spread about the competitive lending rate). So, lending rates are smaller ex-ante for a given net worth level (dashed blue line in figure 6).
- A smaller fraction of entrepreneurs faces lower lending interest rates after the cap. Since there is smaller monopoly power, the number of entrepreneurs positively affected by the cap is smaller. In other words, only entrepreneurs with $n \in [n_1, n_2')$ are now positively affected rather than entrepreneurs with $n \in [n_1, n_2)$, where $n_2' < n_2$.

In a perfectly competitive market, bank profits are zero and the lending rate is given by the dashed black line in figure 6. In that case, the same entrepreneurs are excluded and there is no welfare improvement for any entrepreneur that stays in the formal credit market. This time, the overall impact of the cap on the economy is negative.

Figure 6: *Monopoly Power*



$U_E(n) = n$: Setting the expected profits of entrepreneurs equals n. The dashed black line is the lending rate that makes expected bank profits zero, i.e., this should be the rate in a perfectly competitive credit market: $R(n)$ such that $\pi^F = 0$. I: informal lender.

5.3 Heterogeneous risky projects

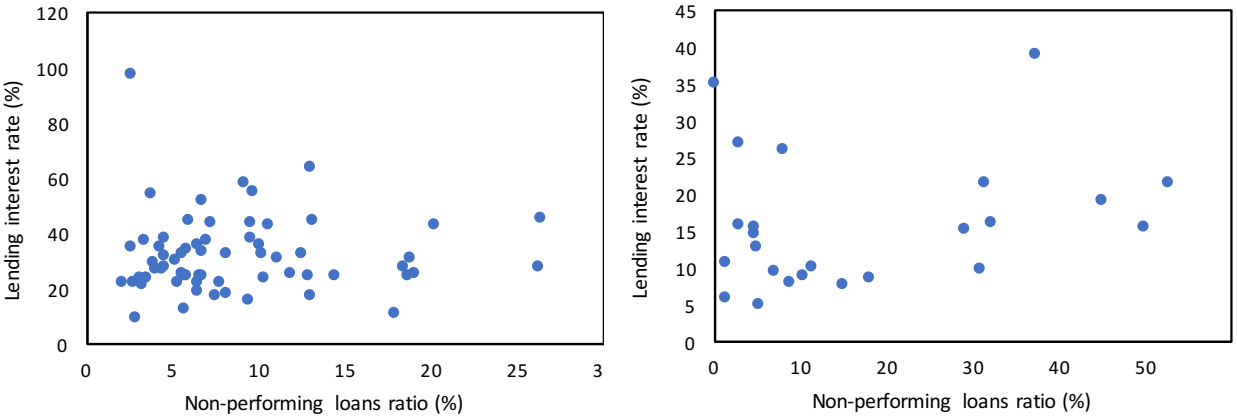
Here, we discuss the implications of dropping the assumption of the same success probability across risky projects. According to equation (2), interestingly, a higher success probability is associated with a higher lending rate. This is, the success probability increases the expected return of entrepreneurs and hence entrepreneurs' capacity to be charged a higher lending interest rate by the monopoly bank. Indeed, this occurs since the market power of the monopoly bank.

So, according to our model a possible explanation for observing in the data a negative correlation between the failure nonperforming loans (NPL) ratio (as a proxy of failure probability) and the lending interest rate (if any) could be the presence of monopoly banks in that credit market. In general, the literature focuses on explaining the determinants of the NPL ratio. Bredl (2021) shows a positive correlation between non-performing loans and lending interest rates using bank-level data from the euro area. However, it does not assess the role of market power. Also, Luozis et al. (2012) find a positive relationship between the NPL ratio and real lending rates in the Greek banking sector.

To our knowledge, no granular studies have been undertaken. For Peru, we did not find any empirical study.

Figure 7 reports the lending interest rate vs. the NPL ratio at the financial institution level (bank and non-bank) in December 2019 for loans to small and micro-sized firms and for domestic and foreign currency for the Peruvian economy.[10] We do not see a clear relationship between the lending rate and the NPL ratio as a proxy of the project failure probability.

Figure 7: *Non-performing loans ratio vs. Lending Rates*



(a) Domestic currency (b) Foreign currency

Source: Superintendency of Banking, Insurance and AFP (SBS). Own elaboration. The lending interest rate is the average interest rate of the operations in the last 30 business days reported by firms' size (small and micro-sized firms) for the end of December 2019.

6 Conclusions

In this work, we develop a simple static banking model with formal and informal lenders and entrepreneurs. We aim to capture the impact of the cap on real and financial variables. In particular, we focus on the extensive margin. We find that in a monopolistic credit market, the cap might reduce the markups of banks and increase entrepreneurs' welfare, but at the same time exclude entrepreneurs with low levels of collateral expanding the participation of informal lenders. In future work, we would like to assess this trade-off in a model that captures the intensive margin as well, and to see the impact of the cap on the financial inclusion process.

[10]Non-bank institutions: *empresas financieras*, municipal credit and saving institutions (CMACs by its Spanish acronym), rural credit and savings institutions (CRACs by its Spanish acronym).

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