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seen through the lens of the
interest rate bias

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Abstract

I compare the explicit and the implicit interest rates for the credits acquired by 5,446 households using data from the Colombian Longitudinal Survey of Wealth, Income, Labor and Land (ELCA). The computation of the interest rate bias (IRB), defined as the difference between the explicit and the implicit interest rates, reveals low levels of financial literacy at different layers: (i) the information required to calculate the interest rate bias is only available for 42.2% of the credits, (ii) 17.4% of the computed interest rates are negative, (iii) the distribution of the IRB reveals that 57.4% of the interest rates are underestimated, whereas the other 42.8% are overestimated. Underestimated credits are more likely to appear on households with higher levels of education, wealth and savings. The average (absolute) IRB is 5.33 points, and is negatively correlated with acquiring the credit in formal financial markets.

JEL Classification: D03, D14

Keywords: household credits, financial education, debt literacy

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1 Introduction

The standard models describing how economic agents make their consumption, saving and borrowing decisions are supported on some assumptions empirically arguable. The most notable and extensively studied are the lack of willpower, the individual's inconsistencies of time preferences and, the aim of this work, the systematic misinterpretation of interest rates and other financial information.

It is usually assumed that individuals are able to plan their consumption trajectories for intermediate and long time horizons. Even if different mechanisms like insurances and precautionary savings are usually introduced in these models to cope unexpected income shocks, they still neglect the irrational but natural lack of willpower to deviate from the optimal consumption path. The theoretical explorations of self-control and willpower (Bénabou and Tirole, 2004) have not been successfully connected to these models of financial economic behavior (Jolls et al., 1998; Mullainathan and Thaler, 2000). There is a growing evidence in the use of commitment devices and contracts with delayed costs. These products encourage the adoption of savings accounts in developing countries and the take-up of voluntary retirement plans (Duflo and Saez, 2003; Thaler and Benartzi, 2004; Ashraf et al., 2006). However, they are the exception rather than the rule in a market plenty of financial products not entirely understood by their consumers.

Another example are the discount factors often assumed in these models, which are time insensitive. The introduction of exponential discount rates implicitly assumes that the value of the reward decays in the same proportion for each time period, independently of its temporal distance to the present. However, preferences' reversals with respect to the exponential discounting model have been diagnosed since the mid-fifties (Strotz, 1956; Thaler, 1981). As an alternative, it has been proposed the hyperbolic discounting model (Loewenstein and Prelec, 1992; Laibson, 1997; Frederick et al., 2002). Unlike exponential discounting, hyperbolic preferences lead to a larger decay in the value of reward per time unit in short time horizons than in long time horizons.

The limitations of the exponential discounting model is extended to the misrepresentation of the interest rates of financial products. The exponential growth bias, a tendency to linearize exponential functions when they are assessed intuitively, interferes with the accurate interpretation of interest rates and leads to systematic underestimation of their values (Stango and Zinman, 2009). This linearization, combined with the overconfidence bias (Tversky and Kahneman, 1974), derives in poor financial decisions which are

individually costly in the long run.

This problem has been tackled on two different fronts: with the regulation on how financial information must be offered to consumers, and with the encouragement of financial literacy programs. Regarding the disclosure of financial information, the Truth in Lending Act signed in 1968 in the United States require lenders to explicitly state the annual interest rates (APRs) of their financial products. However, as shown by [Shu \(2006\)](#), borrowers usually focus on other characteristics of the loan such as monthly payments rather than on the interest rates. In the Colombian case, the country of study, financial institutions are also requested to state the annual interest rates according to the Financial Consumer Protection Regime, established in 2009.

The first diagnoses of financial literacy for the American population appear in the mid-nineties ([Bernheim, 1995, 1998](#)). These initial evaluations aimed to assess the financial planning skills of individuals close to their retirement ages, connecting the shortage in retirement funds to low financial literacy levels ([Lusardi and Mitchell, 2009](#)). Several financial literacy programs were designed to increase the understanding of basic concepts, aiming to empower consumers in their decision-making process. Nevertheless, there has been a lot of skepticism around the effectiveness of their educational impact ([Willis, 2009](#)). The issues of these programs are not limited to the self-selection of participants in some characteristics as time preferences ([Meier and Sprenger, 2012](#)), but they are extended to the difficulties in the transmission of essential financial concepts such as interest rates.

A well-known evaluation of a financial education program with poor results is offered by [Benartzi and Thaler \(2007\)](#). This program was offered, free of charge, to employees of the state of Illinois. To test the efficacy of the program it was administered a test in a True/False format. The test results were not particularly different from those that could have been obtained by guessing, a fifty-fifty chance, before (54%) and after (55%) the intervention.

For the Colombian case, the “National Strategy on Financial and Economic Education” (2010) presents a diagnosis of the financial literacy using a set of questions adapted from the survey conducted in the United States. The results reveal levels of financial literacy below the North American sample. This is particularly worrying having in mind that the survey was only applied in Bogotá to users of formal financial markets, suggesting an overestimation of financial literacy. In addition, it also reveals the need of survey instruments targeting users of informal financial markets, a non-negligible population in developing countries.

A different approach to measure the financial literacy is based on the assessment of subjects’ comprehension of the contract terms of a hypothetical

or their own financial products, and the comparison between the implicit and explicit interest rates. One of the advantages of eliciting the implicit and perceived interest rates, instead of using the standard tests with multiple choice format, is that it allows retrieving a continuous measure of financial literacy. In addition, it reduces the underestimation of the literacy rates usually driven by subjects that guess between the set of possible answers.

Consider for instance the work of [Bucks and Pence \(2008\)](#), who compare borrowers' and lenders' distributions of information regarding their mortgage conditions. Borrowers' responses are the perceived terms, while lenders' responses are the contractual conditions of these credits. They show an average underestimation of interest rates. In addition, they provide evidence that those subjects who are more likely to respond that they do not know the contract terms are more exposed to large payment changes. [Stango and Zinman \(2009\)](#) retrieve the implicit and perceived interest rates for a hypothetical and a real credit, and they define the difference between interest rates as the *interest rate bias*. They show that more biased households borrow more and save less, but they are also more benefited from financial advice.

In this work I use a similar metric to the one proposed by [Stango and Zinman](#) for all the credits reported in a sample of 5,446 Colombian households surveyed in the ELCA. This survey is representative at the urban level. I compare the explicit interest rate with the implicit interest rate, which was calculated using the information of the initial indebted amount as well as the frequency and value of the installments. Debts reported in this survey comprise credits acquired in both formal and informal markets. In the category "informal" are included credits with moneylenders, family and friends, and they constitute more than one quarter of the total number of reports.

The benefits of using real credits instead of hypothetical loans to measure financial literacy come at a cost. It is advantageous because it makes possible the identification of patterns between the interest rate bias and the source of the loan, whether it is a formal or informal credit, and also with the destination of the amount borrowed. It is possible to detect, for instance, if biases are on average lower for consumption credits than for housing loans. Nonetheless, a caveat of this approach is the underlying assumption that when subjects do not report the requested information it is only due to financial illiteracy, forcing the exclusion of other motives such as lack of trust in the enumerator.

Given the importance of informal mechanisms for credit access in developing countries, the main contribution of this work is to offer a comparison of the interest rate bias between credits acquired in formal and informal markets. Similar studies have been carried out with data from developed countries. Therefore, our main contribution is the exploration of the differ-

ential effects of the formal or informal source of the credit.

I provide evidence of the low levels of financial literacy at three different layers of the information disclosure. First, in 57.2% of the reported credits it is not possible to compute the interest rate bias. The most common missing piece of information is the perceived interest rate, not reported in 41.1% of all the credits. Second, among those that provide all the credit's information, 17.4% of the computed interest rates are negative values. Third, the average distance between the explicit and implicit monthly interest rates reaches 5.33 points. Unlike related works, not all the interest rates were underestimated: 42.8% of the credits correspond to overestimated interest rates. The source of the credit, formal or informal market, is highly correlated with the magnitude and the direction of the interest rate bias.

The remainder of this paper is organized as follows. Evidence of financial literacy using survey questions and credit's information is presented in Section 2. Section 3 includes a description of the borrowing and saving behavior of surveyed households, as well as a depiction of the interest rate bias. The results of the selection model use in the regression analysis are shown in Section 4. Section 5 concludes.

2 Related literature

2.1 Diagnoses of financial literacy in the United States

Different studies exposing the lack of financial literacy among the North American population are reported in [Lusardi and Mitchell \(2009\)](#). A module on financial education included in the University of Michigan's Survey of Consumers reveals that responders between 18 and 97 years old answer correctly about two-thirds of the 28 questions in True/False format ([Hilgert and Hogarth, 2002](#)). With respect population-specific studies, there is evidence of financial literacy assessments for population close to their retirement age and high school students ([Lusardi and Mitchell, 2006](#); [Mandell, 2008](#)).

[Lusardi and Mitchell \(2006\)](#) analyze a module on financial literacy included in the *Health and Retirement Study* (HRS) in 2004, a representative sample at the national level of adults who were at least 50 years old. About half of the respondents were able to correctly answer two basic questions on financial literacy¹. For this segment of the population the financial liter-

¹**Question 1:** Suppose you had \$100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow: (a) more than \$102, (b) exactly \$102, (c) less than \$102?

Question 2: Imagine that the interest rate on your savings account was 1% per year and

acy levels are lower for women, African-Americans and Hispanics. Gender differences are explored in depth in [Lusardi and Mitchell \(2008\)](#), showing that women responding “I don’t know” to these two questions are less likely to have made a retirement plan. In the case of Hispanic population, the lower literacy levels are correlated with the lack of access to basic products of financial markets such as banking accounts ([Lusardi and Mitchell, 2006](#)).

The module on financial literacy from the HRS was also included in the *National Longitudinal Survey of Youth* (NLSY) fielded in 2007-2008. [Lusardi et al. \(2010\)](#) find a positive correlation of financial literacy with cognitive abilities, the parents’ experience in financial markets and the number of peers planning to pursue higher education. In addition, it is particularly worrying that the gender and racial gap in financial literacy persists among the youngest proportion of the population, when the average exposition to formal financial products does not greatly differ across groups.

[Lusardi and Tufano \(2009\)](#) surveyed a more specific set of skills of financial knowledge, defined as debt literacy:

“debt literacy refers to the ability to make simple decisions regarding debt contracts, applying basic knowledge about interest compounding to everyday financial choices.”

They collected information on a set of three questions and demographic information for 1,000 respondents of a phone-based survey across the United States. They find that only a third of the respondents exhibit an acceptable comprehension of concepts such as compound interest and basic notions on the workings of credit cards. On average, surveyed individuals underestimate the contracted interest rates, making them more likely to incur in high-cost borrowing. Similar to the case of financial literacy, women, African-Americans and Hispanics perform worst in the test compared to the average population. For debt literacy, the group of divorced, separated and widowed respondents are also performing below the average level.

2.2 The international evidence on financial literacy

A couple of studies perform a cross-country analysis of the financial literacy levels. [Jappelli \(2010\)](#) uses a panel dataset combining information of the *IMD World Competitiveness Yearbook* (WCY) and human capital indicators (e.g. PISA scores and college attendance) for 55 countries between 1995 and 2008. The financial literacy measure comes from a question included in the WCY, a survey responded by business leaders in each one of these countries. They were asked for their perception of the financial literacy among the

inflation was 2% per year. After 1 year, would you be able to buy: (a) more than, (b) exactly the same as, or (c) less than today with the money in this account?

country's population on a scale from 1 to 10. The author finds that human capital indicators are positively correlated with financial literacy, and that inhabitants of countries with high mandated savings as part of their social contributions are more financially illiterate. According to the author, this is a consequence of having lower incentives for private wealth accumulation under these regulatory schemes.

Lusardi and Mitchell (2011) offer an alternative analysis with a more restrained number of countries, eight in total, with measures of financial literacy based on respondents' performance on a test rather than on the businessmen's perceptions. The test is the same administered in the HRS in 2004. Two of their conclusions are related to Jappelli's findings. First, higher scores in math and science tests are correlated with more financial literacy. Second, financial literacy increases if the country has experienced pension privatization. In addition, they also show that financial illiteracy is widespread across developed countries, and that people is more likely to respond a question about inflation if their country recently experienced it.

Evidence of financial literacy levels within Latin America is scarce. For the Chilean case, Mitchell et al. (2008) explore how the inefficient switching patterns between private pension funds are negatively correlated with financial literacy. They analyze how a regulatory modification aimed to increase the switching costs and to help users keep track of their contributions record, by requesting the annual statement issued by their current pension fund in case they wanted to switch to another one. They measure financial literacy using years of education, years of experience in private pension funds and a set of questions regarding the Chilean retirement regulations. The main finding is that the regulatory modification reduced the number of switchings, but the effect was driven by those financially literate.

For Colombia, the Central Bank applied a survey to measure economic literacy and indebtedness in the Colombian households (*Encuesta de Carga y Educación Financiera de los Hogares*) in 2010. They borrowed the standard questions from the HRS to evaluate financial literacy among the Colombian population. Only 44% of the respondents correctly answered the three questions². Compared to the 50% of respondents for the North American sample reported in Lusardi and Mitchell (2009), the result for Colombia is particularly poor if we take into account the sample selection bias. The survey was conducted in Bogotá only with users of formal financial markets; therefore, it is very likely that extending its application to users of informal credits and to less dense urban populations we would observe a drop in literacy rates.

²**Question 3:** Please tell me whether this statement is true or false. "Buying a single company's stock usually provides a safer return than a stock mutual fund."

2.3 Financial literacy and disclosure of credit's information

An alternative methodology to assess financial literacy uses information of actual or hypothetical credits to compare implicit and perceived interest rates. [Bucks and Pence \(2008\)](#) compare the distributions of self-reported and actual mortgage terms matching borrower's data from the *Survey on Consumer Finances* (SCF) with lender's data from two different sources, the *Residential Finance Survey* and the *Loan Performance Corporation*. They find a striking difference between those borrowers with fixed and adjustable mortgage terms. The respondents with adjustable mortgage terms, those more exposed to large change in payments, are more likely to report that they don't know their contract terms.

[Stango and Zinman \(2009\)](#) calculate the interest rate bias for hypothetical and real credit information provided by the households surveyed in the SCF of 1977 and 1983. In the hypothetical credit, the implicit interest rate is calculated after eliciting the expected total repayment for a \$1,000 usd credit with twelve monthly installments. This implicit value is compared to the perceived interest rate for the same hypothetical loan. They find systematic biases for hypothetical and actual loans, with more biased households favoring short-sighted behaviors and getting more benefits from financial advice. In addition, they show that the underestimation of the interest rates is explained by the exponential growth bias: a tendency to linearize exponential functions when they are judged intuitively ([Wagenaar and Sagaria, 1975](#)).

Given the low levels of financial literacy and the lack of effectiveness of the standard financial education programs, recent efforts have been redirected towards the understanding of the most relevant pieces of credit's information to improve the decision-making process. [Bertrand and Morse \(2011\)](#) propose a field experiment in which "more tangible" information than the APR is provided to payday borrowers. The authors show that recalling the debt costs in amount of dollars for different expiration periods of payday loans is more effective in reducing the likelihood to borrow than the information comparing payday loans' interest rate with other credit sources (e.g. credit cards and mortgages). Displaying this information in dollars is also more effective than disclosing the probabilities and costs of refinancing the current loan. Nevertheless, all the three informational treatments show to be more effective than a self-control treatment using a savings planner.

3 Credits and interest rate bias: evidence for Colombia

3.1 Borrowing and saving behavior

I use data from the first wave of the Colombian Longitudinal Survey of Wealth, Income, Labor and Land (ELCA), which was collected between April and July 2010. The survey was conducted both at the urban and rural levels. In this work I focus only on the urban sample, having a total of 5,446 surveyed households which are representative at the national level.

The survey collects information on education, employment, health, housing, income and family composition, as well as detailed information on saving and borrowing behavior. Each head of household was asked if they have any of three different types of debt: loans, delays in payments (e.g. a debt with a public utilities company) and debts with suppliers. The latter two are excluded from this study. Delays in payments, corresponding to 11.3% of the reports, are excluded because they do not correspond to a borrower-lender agreement with some mutually accepted terms, but rather they are the result of a negative income shock or some household's financial misplanning. Debts with suppliers, corresponding to 12.6% of all the reports, are excluded given that contractual terms are either available. One explanation for the absence of contract terms is that delay in payments to the supplier is an intrinsic part of the informal agreements for these entrepreneurial households with low incomes.

The survey has a total of 4,252 reported loans, which means an average of 78 loans for each 100 households. Information on the initial indebted amount, the value and periodicity of the installments and the interest rate was collected for each declared loan. In addition, surveyed subjects were also asked about the lender type and the destination of the debt. Sources and destinations of these loans are reported in Table 1 for different socioeconomic levels or strata. The shares for the different lender types evidence that informal markets are substituted by formal sources of credit as the socioeconomic level increases. This table also shows an increasing proportion of credits to acquire physical assets with the socioeconomic level, whereas for the "any purpose" loans and repayment loans the proportion of credits is larger in the poorest sectors of the population.

Surveyed households were also asked if they save or not, and if so, their average monthly savings was asked too. In addition, they were also asked about where do they keep their savings. This information is fundamental in the study of financial literacy given that systematic differences between net

Table 1: Lender type and loan destination per socioeconomic strata

	Socioeconomic Strata				Total
	1	2	3	4	
Lender type					
Banks and financial institutions	40.21	52.28	60.43	66.71	53.94
Family and friends	20.61	15.30	11.63	8.96	14.55
Retail stores	14.55	12.59	10.88	6.25	11.80
Funds of employees	5.11	10.77	10.06	12.30	9.68
Payday lenders	15.56	6.76	4.79	1.84	7.29
Others	3.96	2.30	2.22	3.94	2.75
Destination of the debt					
Consumer credit	25.29	24.28	28.29	26.68	25.89
Housing	13.42	20.70	17.90	27.80	19.29
Any purpose loan	19.35	16.97	12.73	9.06	15.33
Assets for own business ^a	18.36	11.77	12.21	12.18	13.14
Health, education or recreation	8.44	9.61	9.66	6.02	9.04
Debts repayment	8.30	8.03	8.38	3.17	7.68
Vehicles and lands	3.46	5.11	7.59	13.63	6.43
Others	3.38	3.54	3.23	1.45	3.20

^a Includes assets, inputs, physical installations and machinery.

savers and net borrowers may define if households are willing to incur in the costs of processing financial information.

The saving behavior of households with and without credits is compared in Table 2. This comparison is made for the head of household and his/her partner. According to the statistical tests reported in the table, the percentage of respondents stating that they save part of their income is about 18%, and it does not differ across groups. However, the average monthly savings are slightly higher for the households reporting credits. Saving behavior from the partner is also more frequent in households reporting debts. The same pattern is observed for the average monthly savings.

Regarding the savings' allocation, the proportion of subjects that keep their savings in formal financial markets does not statistically differ between households with and without debts. This is true for both the head of household and his partner. Nevertheless, heads of households with credits are more likely to save in employees' funds and less likely to save in cash with respect to those heads of households that do not report any loan.

3.2 Disclosure of the credits' contract terms

When the diagnosis of financial literacy is based on real credits rather than on hypothetical credits unreported information becomes part of the analysis.

Table 2: Saving behavior for households with/without credits

	HH does have credits (N = 2,618)	HH does not have credits (N = 2,649)	χ^2 statistic
Household's Head			
Does he/she saves?	18.72	18.01	0.44
(Monthly savings Saving) [cop] ^a	185,909	164,572	-1.83*
Where does he/she save?			
Formal financial markets ^b	30.41	30.82	0.02
Cash	37.55	50.52	
Funds of employees	19.39	8.39	
Head of Household's Partner			
Does he/she saves?	70.86	60.44	63.33***
(Monthly savings Saving) [cop] ^a	15.82	12.02	10.28***
Where does he/she save?			
Formal financial markets ^b	166,331	147,500	-1.69*
Cash	26.62	31.25	1.22
Funds of employees	48.12	50.52	
	14.33	8.85	

^a A Mann-Whitney test was performed because the monthly savings were not normally distrib.

^b All responses different from "formal financial markets" were pooled for the test.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

This approach is advantageous in the sense that an incomplete disclosure of the contract terms is a signal of financial illiteracy usually not captured with hypothetical questions used in most of the studies. However, lack of financial knowledge may not be the only reason to unreport financial information. Consider, for instance, the lack of trust on the enumerator. Subjects may misreport their assets or indebtedness level if they do not feel comfortable providing this information to the surveyor.

Table 3 reports that it was not possible to compute the interest rate bias for 57.8% of the reported credits. It means that at least one of the credit's characteristics listed in this table was reported as not known. The most frequently unreported characteristic is the perceived interest rate, unanswered 41.1% of the times. Conditional on giving a number as interest rate, for 21.6% of the credits the surveyed individual did not provide its periodicity. The larger proportion of unreported interest rates is not surprising. As remarked in [Shu \(2006\)](#) and [Bertrand and Morse \(2011\)](#), people tend to focus on more tangible aspects of their credit.

Other credit's characteristics, such as the monthly installments, the remaining months to pay and the remaining amount to pay are unreported less often. However, they still constitute between six and ten percent of the sample. The characteristic with a remarkably low proportion of non-responded

cases is the initial amount of debt, which was incomplete only in 40 out of 4,225 reports (0.99%).

Table 3: Percentage of debts with incomplete information

Characteristic	% of debts without disclosed information			
	Full sample	More than 19 months old	At most 19 months old	χ^2 statistic
Interest rate	41.13	46.73	35.25	44.10***
Periodicity of interest rate ^a	21.63	15.28	27.13	61.29***
Months to pay	10.20	10.19	10.21	0.58
Amount left to pay	8.60	9.59	7.55	9.42***
Monthly installment	6.01	6.10	5.92	0.79
Initial amount of debt	0.99	1.47	0.48	8.44***
Non-computable interest rate bias	57.78	59.08	56.41	0.42

^a Conditional on disclosing the interest rate.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

I also explore if the time since the credit was acquired affect the rates of response for the credit's characteristics. One may think that subjects with more recently acquired credits may be more likely to remember the tangible and intangible contract's conditions, whereas households with older credits may be more likely to remember only the most tangible characteristics of their credit. Credits in the sample are on average 30.1 months old, with a median value of 19 months. The sample was splitted with respect to the median age of the credit and the proportion of unreported information was recalculated for each subsample, as shown in Table 3.

The interest rate, the indebted amount left to pay and the initial indebted amount are less likely to be reported for older credits, whereas there are no statistically significant differences for the expected duration of the credit and the monthly installment. Surprisingly, the periodicity of the interest rate is more likely to be reported in older credits. Given that this periodicity is asked conditional on giving a value of the interest rate, a plausible explanation is that the few households not reporting an interest rate for the most recent credits are the more financially illiterate.

3.3 The interest rate bias

The interest rate bias (IRB hereafter) is defined as the difference between the explicit and the implicit interest rate of a given credit. The explicit interest rate is the value reported to the enumerator. The implicit interest rate refers to the value calculated using additional information of the credit: the initial indebted amount, the total time to pay, and the value and periodicity of the installments. The periodicity of the interest rate was reported on a

monthly basis in 83.4% of the (successfully) reported credits. For comparability purposes, all the interest rates reported in a different time frequency were converted to monthly values prior to the calculation of the IRB. In addition, it was also assumed that all the reports are interest rates in arrears, not in advance.

The distributions of the interest rates, as well as the distribution of the IRB, are displayed in Figure 1³. In panel (a) are compared the distributions for the explicit and implicit interest rates. Interest rates directly reported by the surveyed subjects are highly concentrated in what behavioral scientists call “prominent numbers” (Albers, 2002; Selten, 2002). In our sample, these values are 1%, 1.5%, 2%, 2.5%, 3%, 5%, 10% and 20%. Despite the fact that, in theory, this is a continuous distribution, the 48.6% of the reported interest rates are concentrated in these eight “prominent” values.

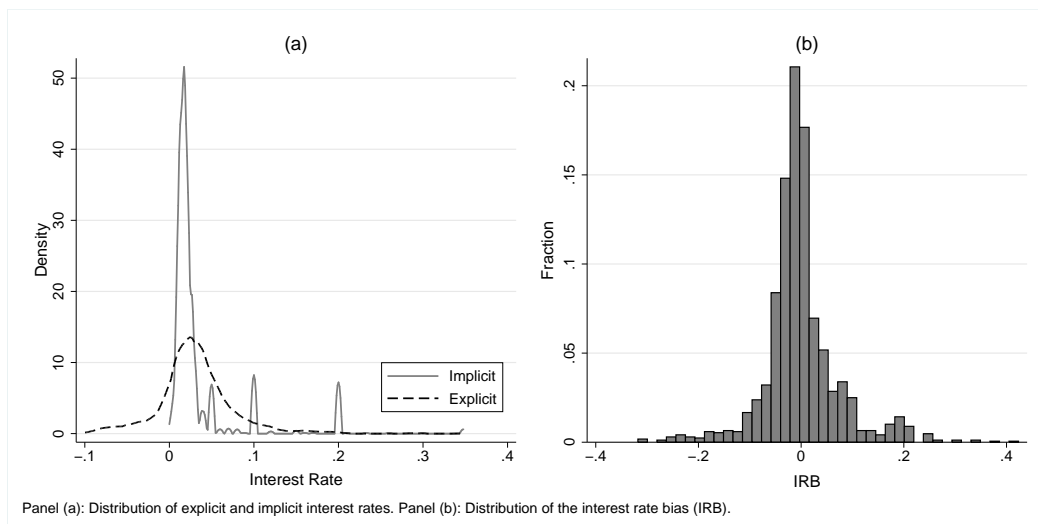
Implicit interest rates follow a unimodal distribution without additional peaks to match the prominent values listed above. The computed interest rates evidence a source of inconsistency that will drive the IRB values away from zero: 17.35% of the computed rates are negative. These values below zero reveal a peculiarity in the disclosure of contract terms: misreports of information are not exclusively related to the interest rate. In order to obtain negative interest rates, some tangible characteristics of the contract such as the installments or the indebted amount must be misreported in such a way that the total repayment of the debt is below the initial borrowed amount.

In Stango and Zinman (2009) is assumed that contract terms different from the interest rate are correctly reported. This assumption, guaranteeing that the IRB measures a bias of the perceived interest rate, is not very plausible for the Colombian sample used in this work. Technically, the difference between interest rates cannot be considered a bias if the implicit interest rate is also a noisy measure. For clarity purposes, and with a slight abuse of notation, I will keep calling this difference the IRB in the remaining of the document.

Panel (b) from Figure 1 displays the distribution of the IRB. The mean value of the IRB is 0.62 points (0.0062) and its median value is -0.58 points (-0.0058). In addition, values between -10 and 10 points (-0.10 and 0.10) represent 85.7% of the sample. A negative IRB value means that the cost of the credit is underestimated, and it corresponds to 57.4% of the observations. This percentage increases to 69.8% if the credits with negative implicit

³For legibility purposes, explicit and implicit interest rates below -10 points (2.2% of the sample) and above 35 points (3.9% of the sample) were excluded from the Figure. Most of the observations with implicit interest rates above 35 points correspond to payday lenders with interest rates set on a daily basis. Given the short periodicity, the conversion to a monthly interest rate is very sensitive to small inconsistencies.

Figure 1: Distributions of interest rates and IRB



interest rates are excluded from the sample.

The IRB suggests an overestimation of the credit's cost in more than forty percent of the observations. Compared to [Stango and Zinman \(2009\)](#) the percentage of reports in which the cost of the credit was overestimated is very high. In their sample, less than 2 percent of the credits' cost turned out to be overestimated.

Given the large proportion of households that perceive their loans as more expensive than they actually are, I look for systematic differences between respondents that underestimated and overestimated their interest rates. Table 4 reports the mean differences for a set of variables related to household's physical and human capital that do not directly appear on the calculations of the IRB. Households that underestimate (with respect to those overestimating) the interest rates are wealthier, more educated, and save more money each month. Borrowing experience, captured through the number of reported credits per household, does not differ across groups.

The positive relationship between the wealth index and underestimating the interest rate can be explained by the elasticity of the perceived price of the credit with respect to the household's wealth. Poorer households are budget constrained, and thus, they have lower bargaining power when they request a credit. If this is true, poorer households are more likely to accept an offered credit, even if they perceived the contractual terms as disadvantageous. A well-known example are the credits acquired with payday lenders.

On the other hand, wealthier households have the chance to be more

Table 4: Differences between households with overestimated and underestimated interest rates

Variable	Overestimated interest rate	Underestimated interest rate	Statistic
Formal financial market ^a [%]	55.85	94.92	384.86***
Wealth index [standardized]	-0.001	0.434	-9.93***
Education head of HH [years]	9.15	10.42	-5.49***
Head of HH saves ^a [%]	76.63	73.39	3.3
Head of HH's monthly savings [cop]	165,718	220,117	-3.07***
Credits reported by the HH	2.40	2.28	0.49

^a A χ^2 test is performed for categorical variables.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

selective with the offered credit conditions, favoring the selection of credits that seem cheaper than they actually are. The differences in the percentage of credits acquired in formal markets across underestimated and overestimated interest rates support this explanation: 94.9% of the underestimations occur with credits in the formal market, whereas for overestimated interest rates its proportion only reaches 55.9%.

4 Regression Analysis

4.1 Factors correlated with IRB and differences between underestimated and overestimated credits

In the previous section was mentioned that the implicit interest rate was only computable for 42.2% of the reports. The least reported characteristic was the perceived interest rate, suggesting that the lack of financial literacy is directly related to an underreport of the contract terms. I estimate a truncated model that corrects for the potential sample selection bias, dampening the endogeneity problems of the model.

Despite the usefulness of the selection equation to control for systematic differences between fully reported and incomplete contract terms, the simultaneity bias due to the relationship between financial literacy and access to formal markets prevails in the main equation of the model. A direct consequence of this issue is that the estimated coefficients cannot be interpreted as causal effects. However, the robustness of several regressions shown in this section will contribute to the understanding of the sources of the biases in the perception of the interest rates among the Colombian urban population.

The truncated model is estimated using a two step procedure. In the first step a Probit model is used to estimate the probability of giving a complete

report of the requested contract terms. If it was possible to compute the IRB of a given credit, it will be considered a “successful report”. The second stage consists on regressing the absolute value of the IRB on a set of covariates including the inverse Mill’s ratio obtained after the Probit estimation. I use the $\|IRB\|$ given the large fraction of overestimated credits in the sample. The inverse Mill’s ratio, the ratio of the probability density function to the cumulative density function of the distribution of the predicted probability from the Probit model, is introduced in the main regression to account for the potential sample selection bias. This procedure is known as the Heckman’s sample selection model (Heckman, 1979).

The coefficients for the full sample, and also for the separate subsamples of underestimated and overestimated interest rates, are reported on Table 5.

For the full sample and each subsample are shown the OLS results and the estimates for each stage of the sample selection model. In the first stage of the selection equation I directly report the marginal effects calculated at the mean value of all the covariates. For simplicity purposes, the coefficients in the main equation will be interpreted in terms of points of interest instead of the simple difference between interest rates.

Columns (1) to (3) report the results for the full sample. OLS estimates are very similar to the main equation of the truncated model, suggesting the absence of a selection bias effect under this specification. The small and statistically insignificant value of λ confirms this intuition. Each additional month since the acquisition of the credit slightly increases the IRB. In addition, having a credit in the formal market is correlated with an average reduction of 8.2 points in the IRB. It is important to make clear that this estimate only remarks the strong correlation between formal markets and financial literacy captured through the IRB, but it cannot be interpreted as a causal relationship. The access to formal financial markets may help reducing financial illiteracy, but those more financially literate could also be more likely to access to formal financial markets.

Although the other covariates are not statistically significant in the main regression, most of them have a significant effect in the selection equation. The participation in formal markets also has an important effect, increasing the probability of a successful report in 12.9 percentage points. Older credits are less likely to be successfully reported. Specifically, each month old reduces the likelihood of a full report in 0.14 percentage points. An additional credit’s characteristic introduced in the selection equation is the initial indebted amount. This value cannot be introduced into the main equation because it is part of the IRB calculation, but since it was reported in more than 99% of the credits it could be introduced into the selection equation.

For each million of Colombian pesos (cop)⁴ initially indebted, the likelihood of a successful report increases 0.28 percentage points.

Schooling years and savings behavior also have an effect on the selection equation despite that their effects were not different from zero in the main equation. An additional year of education increases the likelihood of a successful report in 0.82 points, and having monthly savings increase this likelihood in 4.27 points. Two additional variables only included in the selection equation are the head of household's age and if he/she has a partner or not. Each year old has a positive effect of 0.21 points⁵, and having a partner increases this likelihood in 6.41 points.

I complete the same estimation for the subsamples with underestimated and overestimated credits separately. In the subsample of underestimated credits, for all the observations with an IRB strictly greater than zero this value was reset as non-computable, pooling these observations with the unsuccessfully reported credits. As a consequence, the Probit regression in the sample selection model is now interpreted as the probability of underestimate the IRB with respect to overestimating this bias or providing an incomplete report. The marginal effects, reported in column (6), reveal similar results to the selection equation with the whole sample. In terms of direction and significance of the coefficients, the only difference is that the head of household's saving behavior and his/her report of having a couple are no longer significant. In addition, the λ parameter remains non-significant.

Despite the minor changes in the selection equation, the coefficients in the main equation drastically differ from those in columns (1) and (2). The variable indicating that a credit was acquired in the formal market is no longer significant, which could be related to the fact that almost 95% of the underestimated interest rates belong to these markets.

On the other hand, variables that were not significant in the estimation with the whole sample are now strongly correlated with the IRB. Households reporting a savings behavior have, on average, an IRB 0.76 points lower. Wealthier households show a slight tendency to be more biased, as one additional standard deviation in the Wealth index is correlated with an increase in the IRB of 0.66 points. This result goes in line with the hypothesis of the elasticity to the perceived price of the credits described in Subsection 3.3: physical capital allow households to be more selective in the accepted credit conditions, leading them to acquire credits that they perceive as "cheaper"

⁴At the time of the survey the exchange rate oscillates between 1,850 and 1,950 cop for 1 usd.

⁵In an alternative specification was also included a quadratic term for the age aiming to capture life-cycle characteristics, this variable was not statistically significant and actually reduced the significance of the linear term.

Table 5: IRB (absolute value) as a function of household's characteristics.

Dependent variable: $\ IRB\ $	Full sample						Underestimated ($IRB \leq 0$)			Overestimated ($IRB > 0$)		
	OLS		Truncated model		OLS		Truncated model		OLS		Truncated model	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)			
VARIABLES												
Formal financial market	-0.0802*** (0.0063)	-0.0818*** (0.0066)	0.129*** (0.0183)	-0.0021 (0.0070)	0.0002 (0.0162)	0.306*** (0.0193)	-0.0908*** (0.0069)	-0.0914*** (0.0146)	-0.0936*** (0.0134)			
Education [years]	0.0006 (0.0004)	0.0005 (0.0004)	0.0082*** (0.0018)	0.0007*** (0.0004)	0.0008** (0.0004)	0.0048*** (0.0016)	-0.0002 (0.0007)	-0.0001 (0.0008)	0.0032** (0.0015)			
Months since credit	0.0002*** (0.0001)	0.0002*** (0.0001)	-0.0014*** (0.0002)	0.0004*** (0.0001)	0.0004*** (0.0001)	-0.0004** (0.0002)	0.0001* (0.0002)	0.0001 (0.0002)	-0.0010*** (0.0002)			
Wealth index [standard]	-0.0021 (0.0024)	-0.0022 (0.0021)	-0.0131 (0.0095)	0.0064*** (0.0023)	0.0066*** (0.0022)	0.0088 (0.0080)	-0.0110*** (0.0042)	-0.0111** (0.0044)	-0.0197*** (0.0074)			
Head of HH saves	-0.0056 (0.0037)	-0.0059 (0.0041)	0.0427** (0.0198)	-0.0076** (0.0036)	-0.0076** (0.0036)	0.0154 (0.0162)	-0.0060 (0.0072)	-0.0058 (0.0084)	0.0277* (0.0153)			
Age [years]			0.0021*** (0.0007)			0.0013** (0.0006)			0.0008 (0.0005)			
Head of HH's partner			0.0641*** (0.0169)			0.0203 (0.0143)			0.0458*** (0.0134)			
Reported HH's credits			0.0017 (0.0049)			0.0054 (0.0042)			-0.0031 (0.0036)			
Initial amount of debt			0.0028*** (0.0008)			0.0026*** (0.0006)			-0.0004 (0.0006)			
Constant	0.108*** (0.0068)	0.115*** (0.0239)		0.0229*** (0.0076)	0.0176 (0.0360)		0.125*** (0.0086)	0.122** (0.0578)				
λ (inverse Mills ratio)		-0.0062 (0.0197)			0.0025 (0.0164)			0.0021 (0.0459)				
Observations	1,717	4,168	4,168	985	4,168	4,168	732	4,168	4,168			4,168
R-squared	0.194			0.076			0.274					

For the subsample with underestimated (overestimated) interest rates all the IRB greater (lower) than zero were set as missing values. Standard errors in parenthesis. Robust standard errors computed for OLS regressions. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

even when these are not. Finally, an additional year of education increases the IRB in 0.08 points. Although this effect is statistically significant, its economic relevance is limited: it would be necessary seventeen years of education to raise the IRB in a third of its average value for the underestimated credits.

For the subsample of overestimated credits all the negative IRB values were reset as non-computable, the opposite procedure than for the subsample of underestimated interest rates. As in the previous case, the interpretation of the selection equation differs from the interpretation with the whole sample. I find again that the coefficients in the selection equation are close to the estimates in column (3), although there are two particular exceptions. First, for credits acquired in a formal market the likelihood to report an overestimated credit decreases 9.36 percentage points. Second, an additional standard deviation in the wealth index reduces the likelihood in 1.97 percentage points.

One may think that the negative effects of formal markets and wealth in the selection equation may be driven by the fact that credits with underestimated IRB, whose value was reset as non-computable, are contributing in the Probit model to the failure case (when the IRB is not observable). To address this concern, instead of pooling the underestimated credits with the non-computable IRBs, I dropped all the credits with an $IRB < 0$ from the sample. The results from this alternative calculation are shown in the column (4) in Table A.1. It is observed that the negative effects of formal markets and wealth are robust to this different specification.

Conditional on reporting an overestimated IRB, the coefficient for market type is similar to the value found for the whole sample. Formal markets are correlated with an average decrease of 9.14 points in the IRB, an effect larger than the one displayed on columns (1) and (2). Regarding the wealth index, its effect is statistically significant and goes in the opposite direction than in the analysis with the subsample of underestimated IRBs. An additional standard deviation in the wealth index is correlated with a reduction of 1.11 points in the value of the IRB.

The negative effect of wealth is compatible with the findings from model (3) and (4) and the hypothesis of the elasticity of the perceived interest rate, as those financially constrained households are more likely to accept what they perceive as less favorable contract terms if they have restrained access to other financial alternatives.

4.2 Differences by destination of the debt

In this subsection I explore the heterogeneities in the value of the IRB across different debts' destinations. Consider for instance the housing credits, which may have larger values of the IRB due to the more extended duration of these credits as well as potential variations in contract terms over time (Bucks and Pence, 2008). Another example could be the credits acquired to repay a preexisting debt, for which we could also expect an IRB above the average if financial misplanning is correlated with debt literacy.

I add to the econometric specification a set of indicator variables for the different credit destinations, which is listed in Table 1. Given that in Table 5 the coefficient of the inverse Mill's ratio was not statistically significant for the different specifications, the selection equation and the main equation were estimated separately. Results of this alternative specification are shown in Table 6.

In these regressions the omitted category were the consumer credits. The comparison of the different credit's destinations with consumer credits is useful not only because is the most popular type of credit with 25.9% of the reports, but also because they exhibit the lowest percentage variation between socioeconomic strata. OLS results in column (1) show that the IRB is about 2.1 points higher for consumer credits compared to destinations such as credits for housing and to acquire assets for business. The IRB for consumer credits is also larger than in the case of any purpose loans and health, education and recreation credits. I find no difference in the average IRB between credits aiming to repay older debts and consumer credits.

In column (2) is shown that for some credit's destinations is more likely to have a complete report than for others. Consumer credits are less likely to be successfully reported with respect to other destinations, exceptuating the credits for vehicles and land. This effect is particularly larger if the credit is requested to buy assets for own business or debts' repayment, reaching an increase in the likelihood of a successful report of 15.6 and 16.1 percentage points respectively. Although the average IRB tends to be larger for debts' repayment compared to the vast majority of other credit's destinations, households reporting these repayment loans are the more likely to disclose all the required information to compute the implicit interest rate.

A potential concern with the results in columns (1) and (2) is that the reported correlations for the different destinations are driven by whether the credit was acquired in a formal or informal financial market. For instance, one might be worried that the lower biases in the credits requested for housing, vehicles and lands might reflect the larger participation of banks and other financial institutions. To address this issue, the estimation is repeated

Table 6: IRB (absolute value) as a function of the destination of the debt.
Omitted category are consumer credits.

Dependent variable: $\ IRB\ $	OLS	Selection (marginal)	OLS	Selection (marginal)
VARIABLES	(1)	(2)	(3)	(4)
Formal financial market	-0.0767*** (0.0061)	0.134*** (0.0184)	-0.0774*** (0.0130)	0.0859** (0.0336)
Head of HH saves	-0.0056 (0.0036)	0.0458** (0.0197)	-0.0066* (0.0035)	0.0489** (0.0197)
Housing	-0.0211*** (0.0055)	0.118*** (0.0250)	-0.0411* (0.0243)	0.0555 (0.0513)
× Formal market			0.0230 (0.0246)	0.0818 (0.0574)
Any purpose loan	-0.0228*** (0.00502)	0.0761*** (0.0240)	-0.0502*** (0.0177)	-0.0412 (0.0547)
× Formal market			0.0305* (0.0182)	0.147** (0.0608)
Assets own business	-0.0207*** (0.0057)	0.156*** (0.0245)	-0.0073 (0.0182)	0.139*** (0.0472)
× Formal market			-0.0169 (0.0186)	0.0251 (0.0553)
Health/Education/Recreation	-0.0254*** (0.0060)	0.126*** (0.0286)	-0.0400** (0.0170)	0.102** (0.0509)
× Formal market			0.0198 (0.0176)	0.0315 (0.0615)
Debts' repayment	-0.0019 (0.0091)	0.161*** (0.0291)	0.0160 (0.0219)	0.174*** (0.0462)
× Formal market			-0.0309 (0.0227)	-0.0380 (0.0600)
Vehicles/Land	-0.0155** (0.00692)	0.0475 (0.0353)	0.0465 (0.0718)	-0.178 (0.117)
× Formal market			-0.0646 (0.0720)	0.256** (0.122)
Constant	0.120*** (0.0074)		0.121*** (0.0123)	
Observations	1,717	4,168	1,717	4,168
R-squared	0.213		0.227	

Additional variables included in the main and the selection equation: years of education, wealth index and months since the credit was acquired. In the selection equation are also included the head of household's age, if he/she has a partner, number of reported credits and their initial indebted amount. Standard errors in parenthesis. Robust standard errors computed for OLS regressions. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

including interaction terms between the different debt destinations and the dichotomic variable indicating if the credit was acquired in a formal market.

Results are shown in columns (3) and (4) in the same table.

The larger bias for consumer credits with respect to credits for vehicles, land and assets shown in column (1) disappears. For the other credit's destinations, housing, health, education and recreation, and any purpose loans the magnitude of the coefficients increases considerably. Almost all the interaction terms, with a single exception, are statistically insignificant. In the case of any purpose loans requested on formal markets the IRB is on average 3.05 points larger than for a consumer credit. In addition, saving behavior is correlated with a reduction in the IRB under this specification.

The selection equation, in column (4), reveals that the likelihood of providing a successful report in the case of any purpose loans and credits for vehicles and land is highly correlated with formal markets. In addition, housing credits and its interaction term are not statistically significant under this specification.

4.3 Robustness checks

The results shown along this section may raise a concern given that in the measure of the IRB the explicit and the implicit interest rates may be biased. I propose in this section two different exercises to address this issue. First, I replicate the regression analysis from Table 5 setting all the negative implicit interest rates equal to zero. Second, I replicate all the estimations with the subsample of credits for which the periodicity of the interest rate was reported on a monthly basis.

The first exercise aims to determine to which extent the correlations with the IRB are only driven by the credits in which a negative interest rate was computed. If this is the case, which occurred in 17.4% of the full reported credits, the IRB will systematically lead to larger underestimations of the interest rate. After setting the implicit interest rate in zero it is possible to determine the drop in the magnitude of the coefficients with respect to Table 5. The larger the drop, the more relevant was this mistake in the whole result.

The coefficients from this estimation are reported in Table A.2. As expected, the selection equation is nearly identical⁶ to the regression in Subsection 4.1. With respect to the main equation the signs of all the coefficients remain the same, although the coefficient's magnitudes decreased in about twenty percent. There is very few variation in this magnitude drop between coefficients. For instance, the effect of a credit in the formal market dropped

⁶There are some slight differences in the third digit of the coefficients due to a slight change in the sample size.

from 8.18 to 6.59 negative points in the IRB. On the other hand, the magnitude of the effects of the wealth index increased. An additional standard deviation reduces the IRB in 1.58 points, 0.47 more than in Table 5.

This comparison shows that the results were not mainly driven by the fact that the computed interest rate was negative in about one of every six credits fully reported. After proposing a correction to these mistakes, coefficients in the main equation remain close to the eighty percent of their initial value.

The second exercise consists on an alternative estimation with the subsample of credits directly reported on a monthly basis, which correspond to 83.4% of the observations for which was possible to compute the implicit rate. The purpose of this exercise is twofold. First, to check that the correlations with the IRB are not driven by very large biases in the remaining 16.6% of credits, in which the additional transformation of the interest rate may increase the noise of the IRB value. Second, to determine if, conditional on reporting the interest rate on a monthly basis, the patterns in the selection equation differ from the whole subsample.

The OLS coefficients for the main equation and the marginal effects after the Probit estimation of the selection equation are reported in Table A.3. Regarding the main equation, coefficients in columns (1), (3) and (5) are very robust with respect to the regressions in Table 5, except for the head of household's saving behavior. Conditional on reporting a monthly interest rate, the IRB for households with periodical savings is on average 0.66 lower than for those without them. According to the estimates in column (5), the effect seems to be driven by those cases with overestimated interest rates. In this subset of observations, in which the $IRB > 0$, the IRB is 1.03 lower for households reporting saving behavior.

The effect of formal financial markets is robust to the subsample of credits with a monthly interest rate. However, the coefficient presents a drop of about 16% with respect to the original estimation. One potential explanation of this drop is that interest rates reported in a higher frequency that per month are more usual in informal credit markets. A particular example are the daily interest rates set by payday lenders, in which small deviations from the effective interest rate may lead to larger biases in its transformation to a monthly rate.

Regarding the selection equation, the marginal effects evidence systematic differences with respect to the model in Table 5. The most notable variation is the loss of statistical significance for the head of household's age and schooling years. In addition, the marginal effects for the joint sample of underestimated and overestimated credits also reveal that acquiring the credit in formal markets is no longer having a positive impact on the likelihood to report the credit. Although the general pattern is a loss of predictive

power of the different covariates included the Probit model, for the overestimated interest rates the negative effect of formal markets in the likelihood of providing a successful report goes from -9.36 to -23.6 percentage points.

5 Concluding remarks

I offer a diagnosis of the financial literacy in Colombia using information of the household's real credits instead of the standard literacy tests. An advantage of this approach, particularly in a developing country, is that it allows to explore the perceptual differences in the cost of lending between credits acquired in formal and informal markets.

The initial aim of this work was to compute the implicit interest rate of each reported credit and compare it with the perceived interest rate using the Interest Rate Bias (IRB). Nevertheless, the comparison was only possible to make for 42.2% of the credits. For the remaining observations there was at least one missing piece of information required to calculate the IRB. The most frequently unreported characteristic was the perceived interest rate, a missing value in 71.2% of the unsuccessfully reported credits. This is a first piece of evidence of low levels of financial literacy among the Colombian population.

The second piece of evidence in detriment of the financial literacy levels is the non-negligible proportion of credits with a negative implicit interest rates, which happened in 17.4% of the credits successfully reported. It means that when respondents were asked about the initial value and date of acquisition of the credit as well as their installments, they provide information such that the total amount to pay was less than the initial indebted amount.

Regarding the distribution of the IRB, it is shown that the mean and median values are 0.0062 and -0.0058 respectively. A total of 57.4% of the credits are underestimated, a low proportion compared to the 98% in Stango and Zinman's sample for developed countries. I found that households that underestimate the interest rate are wealthier, more educated and report higher savings. These characteristics support the hypothesis of the elasticity to the perceived price of the credit with respect to the wealth level. In few words, poorer households are more likely to agree on contract conditions even if they consider it disadvantageous, whereas richer households are more likely to accept credits that they perceived as "cheaper". This third piece of evidence of the financial literacy levels, the largest and most studied in this work, show the existence of systematic differences between credits acquired in formal and informal markets that were analyzed in depth using a regression analysis.

The regression analysis took into account two potential problems of en-

dogeneity. First, it was initially expected a sample selection bias under the assumption that respondents who do not successfully report the information about their credit have lower levels of financial literacy. Regression results show that the parameter capturing the sample selection effect was not statistically significant in any of the regressions. The second endogeneity problem was the relationship between the IRB and the credit's source, whether it was a formal or informal financial market. The main problem in this case is that it is not possible to establish a causal relationship: access to informal markets may lead to larger biases; but it is also possible that households with low financial literacy, reflected in a larger IRB, are more likely to be excluded from formal financial markets.

This simultaneity problem implies that coefficients from the regression are biased and cannot be directly interpreted. Given this constraint, I limit the analysis to a comparison of coefficients between regressions for different samples. The comparison between the subsamples of underestimated and overestimated credits provide additional support to the selection of credits according to the household's wealth and their bargaining power. Acquiring the credit is no longer significant for underestimated credits, but the magnitude of the coefficient increases for overestimated credits. In addition, the sign of the wealth coefficient is opposite in the regressions of these subsamples.

The regression analysis also includes some robustness checks. They show that the effects are not only driven by the credits with a negative implicit interest rate nor by the credits reported with a periodicity different to the monthly basis.

Future research in developing countries should aim to combine standard questionnaires of financial literacy with methods including the analysis of real financial information from the households, and perhaps should consider the introduction of framing effects to explore in depth the systematic differences in the perception of formal and informal credits.

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Appendix

A.1 Additional Tables

Table A.1: IRB (absolute value) as a function of household's characteristics. Overestimated (underestimated) credits were dropped from the subsample of underestimated (overestimated) credits.

	Underestimated ($IRB \leq 0$)		Overestimated ($IRB > 0$)	
Dependent variable: $\ IRB\ $	Truncated model		Truncated model	
	Main equation	Selection (marginal)	Main equation	Selection (marginal)
VARIABLES	(1)	(2)	(3)	(4)
Formal financial market	-0.0013 (0.0147)	0.337*** (0.0221)	-0.0894*** (0.0081)	-0.0533*** (0.0167)
Education [years]	0.0008* (0.0004)	0.0065*** (0.0018)	-0.0003 (0.0008)	0.0055*** (0.0018)
Months since credit	0.0004*** (0.0001)	-0.0007*** (0.0002)	0.0002 (0.0002)	-0.0015*** (0.0003)
Wealth index [standard]	0.0065*** (0.0021)	0.0054 (0.0092)	-0.0106*** (0.0039)	-0.0232** (0.0091)
Head of HH saves	-0.0076** (0.0037)	0.0279 (0.0191)	-0.0071 (0.0083)	0.0389** (0.0196)
Age [years]		0.0017** (0.0007)		0.0015** (0.0007)
Head of HH's Partner		0.0363** (0.0165)		0.0657*** (0.0168)
Reported HH's credits		0.0074 (0.0049)		-0.0028 (0.0046)
Initial amount of debt		0.0032*** (0.0007)		0.0005 (0.0008)
Constant	0.0211 (0.0308)		0.139*** (0.0468)	
λ (inverse Mills ratio)	0.0009 (0.0147)		-0.0120 (0.0373)	
Observations	3,436	3,436	3,183	3,183

Standard errors in parenthesis. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A.2: IRB (absolute value) as a function of household's characteristics. Negative implicit interest rates set in zero.

Dependent variable: $\ IRB\ $	Full sample						Underestimated ($IRB \leq 0$)			Overestimated ($IRB > 0$)		
	OLS		Truncated model		OLS		Truncated model		OLS		Truncated model	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)			
VARIABLES												
Formal financial market	-0.0659*** (0.0058)	-0.0659*** (0.0062)	0.127*** (0.0184)	-0.0032 (0.0071)	-0.0031 (0.0162)	0.307*** (0.0194)	-0.0806*** (0.0061)	-0.0806*** (0.0128)	-0.0951*** (0.0135)			
Education [years]	0.0006* (0.0004)	0.0006 (0.0004)	0.0083*** (0.0019)	0.0006* (0.0004)	0.0006* (0.0004)	0.0044*** (0.0016)	0.0001 (0.0006)	0.0001 (0.0007)	0.0036** (0.0015)			
Months since credit	0.0002*** (0.0001)	0.0002*** (0.0001)	-0.0014*** (0.0002)	0.0004*** (0.0001)	0.0004*** (0.0001)	-0.0004** (0.0002)	-0.0001 (0.0001)	-0.0001 (0.0002)	-0.0010*** (0.0002)			
Wealth index [standard]	-0.0035 (0.0023)	-0.0035* (0.0019)	-0.0132 (0.0095)	0.0068*** (0.0023)	0.0068*** (0.0021)	0.0096 (0.0080)	-0.0158*** (0.0038)	-0.0158*** (0.0039)	-0.0205*** (0.0074)			
Head of HH saves	-0.0045 (0.0035)	-0.0045 (0.0039)	0.0424** (0.0198)	-0.0084** (0.0034)	-0.0083** (0.0036)	0.0143 (0.0162)	-0.0014 (0.0065)	-0.0015 (0.0074)	0.0280* (0.0153)			
Age [years]			0.0021*** (0.0007)			0.0013** (0.0006)			0.0008 (0.0006)			
Head of HH's Partner			0.0641*** (0.0169)			0.0188 (0.0143)			0.0473*** (0.0135)			
Reported HH's credits			0.0016 (0.00485)			0.0049 (0.0042)			-0.0027 (0.0036)			
Initial amount of debt			0.0028*** (0.0008)			0.0026*** (0.0006)			-0.0005 (0.0006)			
Constant	0.0887*** (0.0062)	0.0887*** (0.0222)		0.0249*** (0.0076)	0.0245 (0.0357)		0.101*** (0.00740)	0.101** (0.0506)				
λ (inverse Mills ratio)			0.0001 (0.0184)		0.0002 (0.0163)			-0.0002 (0.0399)				
Observations	1,717	4,163	4,163	981	4,163	4,163	736	4,163	4,163			
R-squared	0.162			0.077			0.312					

For the subsample with underestimated (overestimated) interest rates all the IRB greater (lower) than zero were set as missing values. Standard errors in parenthesis. Robust standard errors computed for OLS regressions. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A.3: IRB (absolute value) as a function of household's characteristics.
Explicit interest rates not reported on a monthly basis were excluded from the sample.

VARIABLES	Full sample		Underestimated		Overestimated	
	OLS (1)	Selection (marginal) (2)	OLS (3)	Selection (marginal) (4)	OLS (5)	Selection (marginal) (6)
Formal financial market	-0.0673*** (-0.0047)	0.0199 (0.0254)	-0.0029 (0.0066)	0.358*** (0.0267)	-0.0764*** (0.00537)	-0.236*** (0.0195)
Education [years]	0.0002 (-0.0003)	0.0034 (0.00256)	0.0008* (0.0004)	0.0016 (0.0024)	-0.0006 (0.0005)	0.0017 (0.0023)
Months since credit	0.0002*** (0.0001)	-0.0023*** (0.0004)	0.0002*** (0.0001)	-0.0005 (0.0003)	0.0002** (0.0001)	-0.0020*** (0.0004)
Wealth index [standard]	-0.0002 (0.0020)	-0.0019 (0.0137)	0.0059** (0.0026)	0.0196 (0.0129)	-0.0068** (0.0028)	-0.0185 (0.0121)
Head of HH saves	-0.0066** (0.0031)	0.0641** (0.0264)	-0.0056 (0.0039)	0.0136 (0.0240)	-0.0103** (0.0049)	0.0486** (0.0227)
Age [years]		0.0006 (0.0009)		0.0009 (0.0009)		-0.0004 (0.0009)
Head of HH's Partner		0.0699*** (0.0224)		0.0374* (0.0215)		0.0350* (0.0204)
Reported HH's credits		-0.0026 (0.0065)		-0.0002 (0.0062)		-0.0021 (0.0057)
Initial amount of debt		0.0027*** (0.00105)		0.0031*** (0.0009)		-0.0009 (0.0009)
Constant	0.0973*** (0.0057)		0.0244*** (0.0074)		0.112*** (0.0071)	
Observations	1,434	2,329	794	2,329	640	2,329
R-squared	0.217		0.042		0.343	

Standard errors in parenthesis. Robust standard errors computed for OLS regressions.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$