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Evaluating Informational Regulations in the Credit Market

Ana María Montoya - Carlos Noton - Alex Solis

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Agosto, 2017

RESUMEN

Debido a los bajos niveles de comprensión de algunos consumidores, diversas regulaciones sobre la información que los bancos deben proveer acerca de los costos de los créditos a los consumidores ha sido utilizada por diversos países del mundo. Sin embargo, la efectividad de este tipo de regulaciones de información no han sido evaluadas empíricamente. En el presente estudio utilizamos datos individuales para evaluar los efectos de la regulación en resultados crediticios reales en Chile. Nuestros resultados sugieren que los consumidores en los dos quintiles superiores de ingreso obtuvieron una rebaja en torno al 4% en las tasas de interés en créditos de consumo después de que la regulación se implementó. No encontramos efectos estadísticamente significativos para el resto de la población. Nuestros resultados sugieren que el grado de alfabetización financiera es el principal factor que permite a los consumidores obtener beneficios de la regulación.

ABSTRACT

Regulations on the financial information presented to borrowers are pervasive, mainly because of the unsatisfactory levels of understanding of some consumers. Despite their worldwide use, the effectiveness of informational regulations have not been properly assessed. We use detailed individual-level data to evaluate the effects on actual credit outcomes of this type of regulation in Chile. Our findings suggest that consumers at the top 40 percent in the income distribution achieved four percent lower interest rates after the regulation is implemented. Instead, we find no statistically significant effects for the rest of the population. We explore whether our findings can be explained by educational back ground or search behavior. Our results suggest that financial literacy is the factor that allows consumers to obtain benefits from this type of regulation.

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1 Introduction

How to improve financial decisions of consumers has been a permanent concern for policy makers. The ability of consumers to correctly account for costs and benefits of their options in the credit market is key to achieve an efficient allocation of risk and resources, and also important to ensure the stability of the financial sector (Lusardi and Mitchell (2014)).

However, the financial information is perceived as complex for most consumers. Compelling evidence shows heterogeneous levels of understanding across borrowers, typically showing that poorer and less educated consumers display an unsatisfactory level of thorough understanding (Soll, Keeney, and Larrick (2013)).

Moreover, lending institutions can use information complexity to soften competition as stressed by recent literature (Carlin (2009); Wilson (2010); Piccione and Spiegler (2012); Chioveanu and Zhou (2013)). If firms choose the available information to maximize profits by obfuscating borrowers, then we should expect contracts that are difficult to understand, as well as difficult to compare between different options within and between financial institutions.

Given the evidence on suboptimal decisions and the unclear incentives from the lending institutions, many authorities and researchers have urged for legal regulations on the financial information provided to prospective borrowers (Agarwal, Chomsisengphet, Mahoney, and Stroebel (2015); Woodward and Hall (2012); Campbell (2016)). The assumption is that standardized and simplified amount of information will improve the awareness and understanding of critical aspects of the financial decisions.

Important regulations on the financial information provided to borrowers have been recently implemented in the US and the European Union. The Dodd-Frank Wall Street Reform and the Consumer Protection Act of 2010 have established a Consumer Financial Protection Bureau that requires lenders to disclose cost information of mortgages, student loans, credit cards, and other consumer products in a form that is easy for consumers to use.[1] Similarly, the European Commission has modified the Consumer Credit Directive in November 2011 to ensure a high level of consumer protection by focusing on transparency and consumer rights. Namely, the creditors must

[1]See Campbell, Jackson, Madrian, and Tufano (2011); Campbell (2016); and Posner (2013).

provide pre-contractual information in a standardized form (standard European consumer credit information) that contains the annual percentage rate of charge, which is a single figure, harmonized at EU level, representing the total cost of the credit.

Despite the pervasive introduction of informational regulations, empirical assessments of their effects are virtually non-existent. An important exception is Agarwal, Chomsisengphet, Mahoney, and Stroebel (2015), who study the fee regulation implemented by the Credit Card Accountability Responsibility and Disclosure (CARD) Act.[2] Importantly, the CARD act only regulated fees, and thus, whether informational policies on consumer information are effective remains as an open empirical question.

To shed light on the issue, we study the effects on credit outcomes of a regulation in Chile that standardized the information provided to consumers. In 2012, the Chilean authorities established the mandatory information that should be provided to prospective borrowers. Similar to the European policy, lending institutions must display a salient measure of the yearly interest rates based on the total amount of the credit, including the principal and all the fees involved.

To measure the effects of this regulation, we use every new personal loan approved in the Chilean banking system between the years 2010 and 2014. We include more than 4.4 millions of transactions containing detailed covariates of the borrower (such as income and credit score) and the loan characteristics.

Our estimates suggest that the borrowers at the top 40 percent in the income distribution achieved a sizeable four percent lower interest rates after the regulation was implemented. We find no statistically significant effects on the rest of the consumers. Also, we find no significant effects on loan amount, loan length or default probability across all consumers. Our results are robust to several specifications that considered different sets of explanatory variables and alternative regulation dates as placebo tests.

We explore two potential mechanisms through which the regulation can be effective for the richest borrowers. One hypothesis relies on a better understanding thanks to the new regulated information set, given a set of competing banks. Another hypothesis is that the new regulation facilitates

[2]Using a panel data of 160 million credit card accounts, the authors compare individual consumers, who were subject to the regulation, relative to the small business credit cards, who were not covered by the law. They find that regulatory limits on credit card fees reduced overall borrowing costs by an annualized 1.6% of average daily balances.

comparisons between different banking institutions, increasing the returns to search behavior like quoting the same loan in multiple banks, conditional on a certain level of understanding.

To identify the relative weight of each hypothesis, we include in our analysis a dummy for the financial literacy of the borrower; and the number of banking institutions that the customer has had business relationships in the past. Using a subsample of borrowers for whom we have educational background, we construct a financial literacy dummy based on the financial content of each college degree as classified by the OECD. Additionally, we use the number of banks in the individual history to measure of how prone individuals are to quote the same loan with different banks.

Using a subsample of near 400,000 observations, our preliminary results point out that the educational factors explain most of the *CAE* effects on interest rates for the richest population.

We think our results are relevant to a vast number of markets with complex contracts and non-sophisticated consumers possibly choosing suboptimal decisions. For instance, choices of health insurance, savings for retirement and investment decisions in general may yield similar suboptimal choices for some consumers.

The remainder of this paper is organized as follows. Section 2 presents the regulation we study, institutional details and descriptive statistics of our data. Section 3 presents a model of firms competing in framing complexity with confused consumers. Section 4 presents our econometric approach while Section 5 presents the results and robustness checks. Section 6 tests potential mechanisms that rationalize our findings and Section 7 concludes.

2 *CAE* Regulation and Data

2.1 *CAE* Regulation

In March 2012, the Chilean government passed law 20.555, that introduced a new mandatory format or information frame for the content that should be provided to prospective consumers in a financial transaction. The so-called *CAE* regulation explicitly defined what information should be provided in every single transaction in the credit market, including loans by the financial

institutions, retailers, supermarkets, car dealers, etc.[3]

Similar to the annual percentage rate of charge implemented by the EU, the *CAE* regulation requires the construction of a yearly measure of the interest rate, based on the total amount of the credit, including the principal and all fees involved, besides to clearly state the total debt and number of instalments.

Strictly speaking, the Chilean *CAE* regulation did not provide new information that was not available before. Instead, the *CAE* regulation required the information to be summarized in a salient and simple way and readily available for consumers in all credit markets.

Before the introduction of the *CAE* regulation in Chile, it is fair to assume that the only salient dimension for consumers was the amount of instalment. In fact, retailers and banking institutions focused their entire marketing campaigns mostly on the amount of the monthly instalment. Although other dimensions of the repayment scheme of the loan were available, it was very unlikely for the average consumer ever to request that information.

2.2 Data description

Our analysis is based on micro data requested and recorded by the regulator of banks and financial institutions in Chile (hereafter *SBIF*[4]). The *SBIF* is an autonomous institution that looks after financial stability in Chile and is granted with powerful legal authority to pursue that goal.[5]

We use the individual-level data of all new credits extended by commercial banks for the period between 2010-2014, obtained from SBIF. The data contains credit characteristics (amount, annual interest rate, credit horizon, lending bank), and consumer characteristics (age, gender, income, financial and default history). The total number of observations is approximately 4.4 millions of new loans corresponding to 2,181,895 different individuals.

[3]CAE is an acronym that refers to "Carga Anual Equivalente", that translates as Annual Equivalent Amount.

[4]SBIF is an acronym that refers to "Superintendencia de Bancos e Instituciones Financieras", that translates as Superintendence of Banks and Financial Institutions.

[5]The Superintendence has the authority to examine all the businesses, properties, books, accounts, files, documents and correspondence of the banking institutions without any restriction, and by any means it may deem convenient, and to request from their administrators and personnel all the information and explanations it may consider necessary.

We present summary statistics for our sample, dividing the analysis before and after the introduction of the CAE regulation. Table 1 provide a brief description of the main variables of the credit and individual characteristics before and after the CAE regulation. We present yearly interest rates, loan amounts and individual income, age and individual default probability. From the tables, we can see that the individual characteristics are largely similar before and after the regulation or treatment, slightly differing in a few dimensions.

Table 1: Individual and Loan characteristics before and after the CAE regulation

Before CAE Regulation	mean	sd	min	max	p50	cv	N
Yearly Interest Rate	22,71%	12,90%	0,52%	69,19%	18,6%	0,53	1.576.289
Loan Amount (USD)	6.140,72	9.319,18	146,99	108.778,73	3.111,13	1,51	1.576.289
Yearly Income (USD)	17.492,79	24.842,71	3.034,06	501.264,18	10.627,14	1,42	1.576.289
Female Dummy	36,2%	48,1%	0	1		1,32	1.576.289
Age	42,30	12,44	18,07	74,99	40,64	0,29	1.576.289
Default	13,11%						
After CAE Regulation	mean	sd	min	max	p50	cv	N
Yearly Interest Rate	25,54%	13,10%	0,55%	75,12%	22,4%	0,51	2.831.728
Loan Amount (USD)	7.210,80	10.149,04	147,24	108.778,73	4.033,18	1,40	2.831.728
Yearly Income (USD)	17.345,79	21.755,74	3.034,09	502.734,16	10.950,05	1,26	2.831.728
Female Dummy	37,4%	48,3%	0	1		1,29	2.831.728
Age	42,86	12,55	18,01	74,99	41,21	0,29	2.831.728
Default	14,59%						2.831.728

The main source of heterogeneity in the data is income, thus Figure 1 shows the evolution of the weighted average of the interest rate for the years between 2010 and 2014 for each quintile of the income population, showing the regulation date in a vertical red line. We can see different patterns between the lowest quintile and the top quintile in terms of the level of the interest rate and their volatility. We present the same summary statistics for each income quintile in the appendix section A, stressing that neither demographics nor income seems to change before and after the regulation.

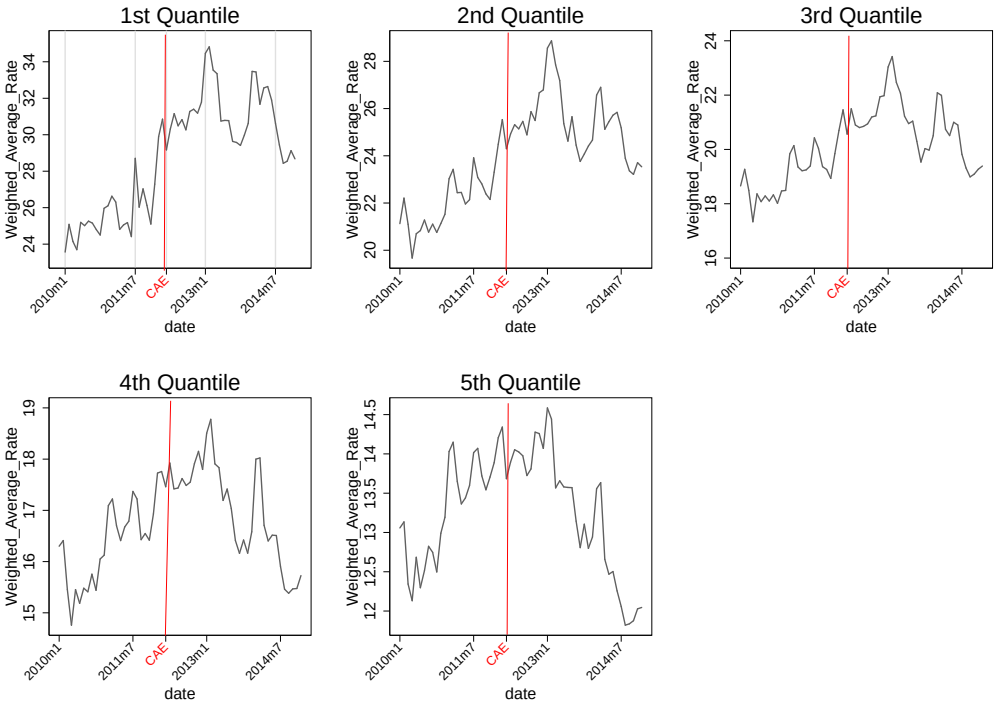

Figure 1: Weighted Average Loan Interest Rate by quintile, 2010-2014

3 Theoretical Framework

Models aim at rationalizing effects of framing in consumer behavior should allow for consumers and suppliers to have different information sets or heterogeneous levels of understanding (Stigler (1961) and Ippolito (1988)). The level of information of consumers depends on the quality of the available information and the search costs. Thus, some consumers might not be perfectly informed usually failing to make optimal decisions and suppliers enjoying market power (Stahl II (1989)).

There is evidence that more complex informational frames are associated with higher prices. Woodward and Hall (2012) show that borrowers in the mortgage market who choose to roll all settlement costs into a single rate obtain, on average, lower interest rates than those on deals with separate fees. The idea is that the informational advantage of the broker is less severe when borrowers can shop on the basis of a single rate alone.

We explore recent developments in theoretical models of non-standard but rational consumers that can explain how consumers could benefit from the new information framing imposed by the *CAE* regulation. Thus, we adapt the framework developed by Chioveanu and Zhou (2013) (hereafter CZ).

Consider a credit market with two financial institutions, bank 1 and 2, whose constant marginal costs of capital are normalized to zero. There is a unit mass of consumers, each borrowing at most one unit of credit and willing to pay at most 1.

There are two alternative information frames for interest rates, referred to as frames A and B. We assume that frame A is a simple frame (in which the two interest rates are easily comparable) and that frame B is a a more complex frame, in which not every consumer is able to perfectly compare alternative options. Each bank i will choose frame $z_i = \{A, B\}$, so the vector of frames will be $Z{=}(z_1, z_2)$ and the share of the population that gets confused is denoted by $\alpha(Z){\in}[0,1)$.

The banks simultaneously and non cooperatively choose frames and interest rates r_1 and r_2; the demand function is given by $q_i(r_i, r_j)$. If firm i is the cheapest option ($r_i < r_j$), then firm i captures the entire demand ($q_i = 1$) and firm j has no customers ($q_j = 0$). When both banks set identical prices, $r_i = r_j$, each bank serves half of the demand: $q_i = q_j = \frac{1}{2}$.

If both banks choose the same simple frame, $Z = (A, A)$, then almost nobody gets confused, $\alpha(A, A) = \alpha_0 \geq 0$, and most consumers buy the cheaper product with a positive net surplus.

If the two banks adopt different frames, $Z = (A, B)$ or $Z = (B, A)$, then a larger fraction $\alpha(A, B) = \alpha(B, A) = \alpha_1 > \alpha_0 \geq 0$ of consumers gets confused and they are unable to compare the two alternative options. The remaining $(1 - \alpha_1)$ fraction of consumers can still accurately compare interest rates. In this duopoly example, for simplicity, we assume that confused consumers shop at random: half of them buy from bank 1 and the other half buy from bank 2.[6]

If both firms choose the same complex frame B, ie $Z = (B, B)$, then a larger fraction $\alpha(B, B) = \alpha_2 > \alpha_1 > \alpha_0 \geq 0$ of consumers get confused and shop randomly. In this setting frame complexity leads to a larger share of confused consumers than does frame differentiation.

[6]Similar results can be obtained if consumers favor the bank with the simpler frame whenever facing two different frames. See Chioveanu and Zhou (2013).

Notice that the simple frame A can cause confusion only when it is combined with a different frame B, whereas frame B is confusing by itself and can obfuscate price comparisons even if both firms adopt it. Also, in this setting consumers have limited cognitive capabilities that prevent them to infer prices from the information frames.

Firm i's profit is

$$\pi_i(r_i, r_j, z_i, z_j) = r_i \times \left(\frac{1}{2} \times \underbrace{\alpha(Z)}_{\text{confused-share}} + q_i(r_i, r_j) \times \underbrace{(1 - \alpha(Z))}_{\text{non-confused-share}} \right)$$

Proposition 2 in CZ shows that there is a unique symmetric mixed-strategy equilibrium where each bank adopts frame A with probability $\lambda = \lambda(\alpha_0, \alpha_1, \alpha_2)$ and frame B with probability $(1 - \lambda)$. When a bank uses frame A, it chooses its price randomly according to the cdf F_A defined on the support given by prices in the $[\underline{p}, \hat{p}]$ interval and when a firm uses frame B, it chooses its price randomly according to the cdf F_B defined on support $[\hat{p}, \bar{p}]$, which contains more expensive prices.

The implications for the authorities are straightforward: 1) the market equilibrium involves mixing simple and complex frames that exploits the share of confused customers; 2) if the regulators establish the simple frame A as the mandatory frame in the credit market, the share of confused customers will fall.

Importantly, the reduction in the share of confused consumers due to a change in the information frame can be explained by two forces that play simultaneously: i) a better understanding of the credit market (given by the relative simplicity of frame A) conditional on certain search behavior; and ii) an easier comparison between banks that can be rationalized as a decrease in search costs, conditional on a certain level of understanding.

4 Econometric Approach

Our econometric approach seeks to quantify the effect of the *CAE* regulation on different financial outcomes. Namely, we estimate reduced form regressions to measure the effect of the new regulation on interest rates and credit amounts.

4.1 Interest Rate Regressions

The first specification in Equation (1), denoted by Model 1, is as follows:

$$Y_{ikt} = \alpha' X_{it} + \beta CAE_t + \theta\, CAE_t \times Income_{it} + \gamma_1 Le_{ikt} + \gamma_2 Am_{ikt} + \lambda_t + \lambda_k + \varepsilon_{ikt} \tag{1}$$

where Y_{ikt} is the annual interest rate charged by bank k to consumer i at time t; X_{it} is a vector of individual characteristics such as gender, age and income; CAE_t is a dummy variable equal to one after March 2012, and zero otherwise; Am_{ikt} is the log of the loan amount, Le_{ikt} is the length or maturity of the loan. We also include monthly fixed effects, λ_t, and bank fixed effects, λ_k. ε_{ikt} is the standard individual time-varying random term that is assumed to be independently distributed.

Our key estimate of interest is β and θ, which represents the effect of the CAE regulation on interest rates. The main identifying assumption is that changes in credit conditions after the law was passed are captured by additive terms over the interest rate level that banks would have charged in the absence of the law.

In Model 2, we estimate different treatment effects of the regulation by each quintile of the income distribution of the borrowers, as described in Equation (2).[7] The treatment effects are captured by the interaction of the CAE dummy and each income quintile dummy. The effect on quintile j is denoted by θ_j:

$$Y_{ikt} = \alpha' X_{it} + \beta CAE_t + \sum_{j=1}^{5} \theta_j CAE_t \times Quintile_{ijt} + \gamma_1 Le_{ikt} + \gamma_2 Am_{ikt} + \lambda_t + \lambda_k + \varepsilon_{ikt} \tag{2}$$

where $Quintile_{ijt}$ is a dummy variable equal to one if the individual i belongs to quintile j at time period t and zero otherwise.

In the next specifications we account for the fact that the log loan amount Am_{ikt} and credit length Le_{ikt} are potentially endogenous variables. If the amount or the length agreed by the consumers depends on the interest rates of the loan, then we can have a standard reverse causality problem. To address this potential endogeneity problem, we also estimate the models 1 and 2 using Two Stage Least Squares (TSLS), considering marital status

[7] Note we define the income quintiles using the population of borrowers in the banking sector that is richer than the Chilean population.

and individual default in the banking system as instrumental variables for amount and length.

We argue that marital status is correlated with the amount of credit but uncorrelated with random term ε_{ikt}. We believe that, ceteris paribus, married individuals need higher amounts to finance larger projects (housing, familiar vacations, children expenditure, etc) than single borrowers. The assumption is that marital status only affect interest rates through the amount of the loan.

Similarly, we argue that the interest rates are based on the latest information on default but not on the previous default history. However, default history can be linked to past negative shocks that explains the necessity of larger amounts and longer credit length. Our measure of *default history* is given by the ratio of total amount that consumer did not pay in the maturity date in the banking institutions with respect to the total loan amount two periods lagged.

The instrumental variables are valid if and only if they are uncorrelated with the error term of the structural equation and strongly correlated with the endogenous explanatory variables. Hence, the instruments must be exogenous (over-identification test) and also must be relevant (underidentification test). We applied the underidentification, weak underindentification and overidentification tests to support the use of our instrumental variables.[8]

4.2 Loan Amount Regressions

We also explore the effect of the CAE regulation on the log amount of the loans. Thus, we use the log amount of credit as dependent variable in the same type of regressions described previously, also including the interest rate as explanatory variable. The regression described in Equation (3) is denoted by Model 3:

$$Am_{ikt} = \alpha' X_{it} + \beta CAE_t + \theta\ CAE_t \times Income_{it} + \gamma_1 Le_{ikt} + \gamma_2 Y_{ikt} + \lambda_t + \lambda_k + \varepsilon_{ikt} \tag{3}$$

In Model 3, we have to account for the fact that the interest rate and credit length are endogenous variables. Thus, we use the interaction between the interbank interest rate and bank fixed effects as instrumental variables. These interactions capture the asymmetric bank responses to cost shocks that

[8]We use Frisch-Waugh-Lovell (FWL) to estimate the Hansen test. For more information see Hahn and Hausman (2002).

should affect banks differently depending on the finance structure of each corporation. These cost shifters are completely exogenous to consumer-specific shocks and definitely correlated with the aforementioned endogenous variables as financial institutions should change their optimal policy regarding interest rates and maturity of loans.

5 Results

5.1 Interest Rate

We present our OLS and TSLS estimates of Model 1 (See Equation (1)). The first stage of the TSLS specification is shown in Table 2. We cluster standard errors at the bank level.

Table 2: First Stage of Model 1

Dependent Variable	Log Loan Amount	Credit Length
Default History	0.063*	5.447***
	(0.035)	(1.675)
Single	0.001	-2.402***
	(0.023)	(0.285)
Married	0.105***	-0.271
	(0.032)	(0.029)
Divorced	0.113***	0.051
	(0.036)	(0.455)
Number of observations	4,407,305	4,407,305
F Test Excluded Instruments	87.02***	29.01***

Notes: clustered standard errors by bank in parentheses. Marital status are relative to the base of *widow status*. Coefficients of other control variables are omitted. *p<0.10, **p<0.5, ***p<0.01.

From Table 2 we conclude that our instruments satisfy the exogenous and identification conditions, and therefore, the endogeneity issue is properly addressed in the second stage. Our results suggest that married and divorced consumers borrowed larger amounts relative to single or widow individuals, consistent with our priors. Regarding the length of the credit horizon, we

find evidence that consumers who are single and had a better default history[9] borrow shorter maturity debts.

Table 3: Model 1: CAE effects on Interest Rates

Interest Rate	OLS	TSLS
Log Loan Amount	-4.783***	-4.461
	(1.148)	(4.482)
Income	-2.22e-07***	-2.24e-07
	(4.58e-08)	(1.88e-07)
Squared Income	1.06e-15***	9.98e-16
	(2.25e-16)	(6.47e-16)
CAE	**-3.942**	**-3.873**
	(2.733)	(2.569)
CAE x Income	**-6.86e-08*** **	**-6.37e-08*** **
	(3.02e-08)	(2.55e-08)
Credit Length	-0.030	-0.318
	(0.026)	(0.207)
Female Dummy	-0.845*	-1.225**
	(0.482)	(0.624)
Number of observations	4,407,305	4,407,305
Adj R2	0.46	0.26
Bank Fixed Effects	√	√
Time Fixed Effects	√	√
Hansen Statistic		3.823
Underidentifiction KleibergenPaap rk LM		4294.973***
Weak identification KleibergenPaap rk F		1020.481***

Notes: clustered standard errors by bank in parentheses. *p<0.10, **p<0.5, ***p<0.01.

Table 3 presents the estimates of Model 1. We find that consumer credit cost decreases after the CAE regulation, and, on average, the size of this effect depends positively on the income of the borrower. The average effect at the mean of income is equal to -0.81 points in the OLS estimation and -0.75 in the TSLS estimation, being the effect equivalent to a reduction of 3% of the average interest rate. Note that the CAE effect is only significant when interacted with the borrower's income.

[9]An smaller share of unpaid debts two periods lagged.

All other covariates obtained the expected effects, as credit length, gender and income quintile are also significant explaining interest rates.

Now, we turn to estimate Model 2 presented in Equation (2). In Table 4, we present the first stage estimates of the TSLS estimation. The results are similar to those obtained in the first stage of Model 1, except by the fact that the default risk is not significant for the log loan amount.

Table 5 presents the main estimates of Model 2. We find that borrowers in the 4th and 5th quintile of the income distribution, obtained statistically significant lower interest rates after the CAE regulation was in force. The average interest rate decrease is about 4.5 points in the 4th quintile and 5.5 points in the top quintile of the income distribution. The effect is equivalent to a sizeable reduction of 20 percent of the average interest rate in the 4th quintile and 30 percent in the 5th quintile.

We explore empirically two potential mechanisms in section 6 to rationalize our findings of negative CAE effects on interest rates for the borrowers at the top of the income distribution.

5.2 Credit Amount

We also study the effect of the CAE regulation on the loan amount. Table 6 presents the estimates of Model 3 as described in Equation (3). We find no evidence of significant effects of the CAE regulation on the log loan amount of consumers in the banking system. The interaction of the CAE and income does not suggest any heterogeneous effect on the total loan amount.[10]

[10]The first stage estimates support the cost shifters as valid instruments. See Table 15 in B.

Table 4: First Stage of Model 2

Dependent Variable	Log Loan Amount	Credit Length
Default History	0.060	5.496***
	(0.035)	(1.728)
Single	0.007	-2.510***
	(0.016)	(0.294)
Married	0.077***	-0.495*
	(0.023)	(0.262)
Divorced	0.079***	-0.192
	(0.027)	(0.393)
Widow base		
Number of observations	4,407,305	4,407,305
F Test Excluded Instruments	53.26***	29.13***

Notes: clustered standard errors by bank in parentheses. Coefficients of other control variables are omitted. *p<0.10, **p<0.5, ***p<0.01.

Table 5: Model 2: CAE Effects on Interest Rates by Income Quintile.

Interest Rate	OLS	TSLS
Log Loan Amount	-4.143***	-0.943
	(1.010)	(4.823)
Quintile 1 x CAE	-0.267	-0.430
	(2.451)	(2.189)
Quintile 2 x CAE	-2.127	-1.976
	(2.806)	(-2.485)
Quintile 3 x CAE	-3.947	-3.777
	(2.751)	(2.704)
Quintile 4 x CAE	-4.661*	-4.459*
	(2.326)	(2.320)
Quintile 5 x CAE	-5.669**	-5.454**
	(2.351)	(2.400)
Credit Length	-0.041*	-0.367*
	(0.022)	(0.190)
Female Dummy	-0.787*	-0.947*
	(0.436)	(0.565)
Number of observations	4,407,305	4,407,305
R2	0.501	0.290
Bank Fixed Effects	√	√
Time Fixed Effects	√	√
Quintile Fixed Effects	√	√
Hansen Statistic		6.086
Underidentifiction KleibergenPaap rk LM		2975.899***
Weak identification KleibergenPaap rk F		403.377***

Notes: clustered standard errors by bank in parentheses. *p<0.10, **p<0.5, ***p<0.01.

Table 6: Model 3: CAE effects on Loan Amount

Log Loan Amount	OLS	TSLS
Interest Rate	-0.031***	0.045***
	(0.006)	(0.013)
Income	3.19e-08***	6.51e-08***
	(3.39e-09)	(9.94e-09)
Squared Income	-1.08e-16***	-2.45e-16***
	(1.46e-17)	(4.25e-17)
CAE	**-0.121**	**0.178**
	(0.108)	(0.133)
CAE x Income	**-1.48e-09**	**3.88e-09**
	(1.61e-09)	(3.19e-09)
Credit Length	0.0182***	0.039***
	(0.00572)	(0.014)
Female Dummy	-0.0755***	-0.017
	(0.021)	(0.034)
Number of observations	4,407,305	4,407,305
Adj R2	0.59	0.14
Bank Fixed Effects	√	√
Time Fixed Effects	√	√
Hansen Statistic		11.824
Underidentifiction KleibergenPaap rk LM		9043.523***
Weak identification KleibergenPaap rk F		579.663***

Notes: clustered standard errors by bank in parentheses. *p<0.10, **p<0.5, ***p<0.01.

5.3 Robustness Check

In this subsection we perform various robustness check to test our findings. Based on Model 2, we estimate a difference-in-difference specifications to evaluate the robustness of our findings on the CAE effect on the interest rates. We consider the 2nd and 1st income quintiles as control groups for the 4th and 5th income quintile respectively (we discard the 3rd quintile of the income distribution). Table 7 presents the dif-in-dif estimates. We obtain very similar results: the CAE regulation only decreased the interest rate paid by the borrowers at the top 40 percent of the income distribution.

Table 7: Difference-in-Difference Estimation

Interest Rates	OLS	TSLS
Log Loan Amount	-4.049**	-1.398
	(1.007)	(4.199)
Quintile 1	8.119**	10.93*
	(1.321)	(6.038)
Quintile 2	4.780**	7.544
	(1.042)	(4.943)
Quintile 4	1.265**	2.635
	(0.513)	(2.009)
Quintile 4 x CAE	-3.394*	-3.230*
	(1.776)	(1.871)
Quintile 5 x CAE	-4.421**	-4.156**
	(2.090)	(1.988)
Credit Length	-0.0399*	-0.379**
	(0.0222)	(0.183)
Female Dummy	-0.783	-0.929
	(0.514)	(0.704)
Number of observations	3,541,901	3,541,901
Adj. R2	0.53	0.30

Notes: clustered standard errors by bank in parentheses. *p<0.10, **p<0.5, ***p<0.01.

As another important robustness check, we explore different dates as the definition of the establishment of the CAE regulation. We estimate the OLS specification defining the CAE regulation being in force five months before (November 2011, when the Chilean Government promulgated the Law). The results show that using previous dates do not have the significant effect on the interest rates. We find similar results when we estimate a placebo test considering only the observations in pre-treatment period and assigning a treatment in January 2011. We present the results in Table 8.

Table 8: Testing alternative CAE definitions

	(1)	(2)	(3)
Interest Rates	March 2012	Nov 2011	Jan 2010
Log Loan Amount	-4.143**	-4.144**	-3.903**
	(1.010)	(1.011)	(1.202)
Quintile 1 x CAE	-0.267	1.407	0.993
	(2.451)	(3.176)	(1.553)
Quintile 2 x CAE	-2.127	-0.374	2.113
	(2.806)	(2.969)	(1.333)
Quintile 3 x CAE	-3.947	-2.099	1.900
	(2.752)	(2.538)	(1.612)
Quintile 4 x CAE	-4.661*	-2.895	1.703
	(2.327)	(2.047)	(1.625)
Quintile 5 x CAE	-5.669**	-3.929*	1.778
	(2.352)	(34.58)	(1.541)
Credit Length	-0.0413*	-0.0412*	-0.023*
	(0.0227)	(0.0226)	(0.010)
Female Dummy	-0.787*	-0.898*	-0.347**
	(0.437)	(0.494)	(0.154)
Number of observations	4,407,305	4,407,305	1,433,838
Adj. R2	0.501	0.500	0.518
Bank Fixed Effects	√	√	√
Time Fixed Effects	√	√	√
Quintile Fixed Effects	√	√	√

Notes: clustered standard errors by bank in parentheses. *p<0.10, **p<0.5, ***p<0.01.

Another important robustness check is to test whether the groups for which a treatment effect is found had a pre-treatment trend that could explain the results. We label the poorest 1st and 2nd quintile at the bottom of income quintile as the control group, while the richest 4th and 5th quintile at the top of the income distribution are labelled as the treatment group. The key identifying assumption of our reduced form estimates is that interest rate trends would be the same in both groups of consumers in the absence of treatment, ie, using the pretreatment data only.

Table 9 presents the described pre-treatment trend test. Treatment induces a deviation from this common trend. In the results obtained, we

Table 9: Parallel Trend in Pre-Treatment period

Interest Rates	(1) OLS
Log Loan Amount	-4.127** (1.195)
Control Group Dummy	36.57 (35.53)
Credit Length	-0.0185 (0.0126)
Trend	0.209** (0.0670)
Trend x Control Group Dummy	**-0.0694** **(0.0576)**
Female Dummy	-0.130 (0.113)
Number of observations	1,267,453
Adj. R2	0.532

Notes: clustered standard errors by bank in parentheses. The control group only includes the poorest 40 percent of the income distribution. *p<0.10, **p<0.5, ***p<0.01.

strongly do not reject that there is no difference between both groups trends. Therefore, the results are consistent with the findings that the CAE regulation did affect the interest rates that the richest 40 percent of borrowers achieved.

5.4 Discussion of Results

Our main finding is that the CAE regulation had heterogenous effects on the interest rates across the income distribution. We find a sizable decrease in the interest rates for borrowers at the top 40 percent of the income distribution. The four percent reduction is about a fifth of the average interest rate of 20 percent of the population. Instead, we find no significant effects on interest rates for borrowers at the bottom 60 percent of the income distribution.

Notice that the absence of effects can have two interpretations: i) evidence of an irrelevant regulation; or ii) the behavior at the bottom of the income distribution was already optimal before the CAE regulation was implemented with no room for improvement. In general we are able to detect changes in outcomes but not whether those outcomes were optimal before or after the implementation of the CAE regulation. However, the abundant evidence that Chilean borrowers have trouble to understand financial information, lead us to believe that the second scenario is less likely than the first one.

We perform several robustness checks (different measures, specifications and placebo tests) that ensures our main results. Non-significant results on loan amount, default probability and credit length are consistent with the theoretical model where the expected effect is mainly on prices.

Given our solid findings, next we explore potential mechanisms that can rationalize our results.

6 Mechanism

We have two potential explanations to rationalize our findings of a negative CAE effect on the interest rates but only for the richest borrowers. One hypothesis is that the CAE effect is related to higher educational levels, and therefore, higher levels of financial literacy. The other hypothesis is that the CAE regulation boosts search behavior among rich borrowers since comparisons between and within banks are easier. Hence, regardless of their level of financial literacy, richer individuals face more and better options when quoting the same loan in different banks.

To study the two competing hypotheses, we require to have data on educational background that is not available for the entire sample. Instead, we only have records of educational background for a sub-sample that corresponds to the borrowers between 18 and 35 years old, who took the national

exam of college admissions in 2007.

To test the aforementioned financial literacy hypothesis, we build a measure of "exposure to financial education" using the classification made by the OECD. We consider as the treatment group those students who have enrolled in university programs classified as Business Education.[11] We interact our financial literacy dummy with quintile to allow for different effects across the income distribution.

To test whether the CAE effect is mainly driven by search behavior, we construct the number of banks that the consumer has had financial products in the past. The intuition is that the number of banks is a good proxy for consumer search, as a larger number banks suggest that it is more likely to quote the same loan with different banks.

Using the difference-in-difference approach, we include both set of regressors to estimate the effects of financial literacy and searching behavior. We expect to identify the relative weight of each hypothesis. Table 10 presents our estimates to disentangle the underlying mechanism of the CAE regulation.

Our estimates support the hypothesis that financial literacy is the main source of the statistically significant decrease on interest rates after the CAE regulation is in force. After the CAE regulation, the level of financial literacy is strongly negative for the richest quintiles only. Therefore, we conclude that the hypothesis of financial literacy is supported by the data to explain the CAE effect in the Chilean credit market.

Regarding the search behavior, we find that borrowers, who have financial products in more than one bank, achieve higher interest rates after the CAE regulation is in force that is contrary to our hypothesis of searching behavior. This could happen because multi-bank individuals have more experience in the financial system, therefore the gap between them and consumers with only one bank is higher before the CAE regulation. Once the CAE regulation simplified the informational frame this gap decreased.

[11] For example, the OECD classifies education programs in seven groups: Agriculture; Sciences; Social Sciences and Business Education; Education; Humanities and Arts; Engineering, Manufacturing and Construction; and, Health and Welfare Services

Table 10: Mechanisms that affect Interest Rate through CAE Regulation

Interest Rates	OLS	TSLS
Female Dummy	-0.182*	0.0446
	(0.0653)	(0.154)
Female Dummy x CAE	0.134	0.186
	(0.0845)	(0.168)
Credit Length	-0.0433**	-0.241*
	(0.00144)	(0.138)
Fin Litera x Q1	-2.729*	-2.000*
	(0.975)	(1.174)
Fin Litera x Q2	-2.309**	-2.418**
	(0.0881)	(0.113)
Fin Litera x Q3	-0.579**	-1.018**
	(0.126)	(0.0994)
Fin Litera x Q4	-0.262	-0.386**
	(0.173)	(0.176)
Fin Litera x Q5	0.745**	1.330*
	(0.196)	(0.726)
Fin Litera x Q1 x CAE	1.993**	0.673
	(0.0736)	(0.995)
Fin Litera x Q2 x CAE	1.430**	1.607**
	(0.0882)	(0.193)
Fin Litera x Q3 x CAE	-0.529**	0.230
	(0.0965)	(0.456)
Fin Litera x Q4 x CAE	-0.641**	-0.316*
	(0.109)	(0.162)
Fin Litera x Q5 x CAE	-1.290**	-2.070*
	(0.167)	(0.640)
Multi-bank	-0.938**	-1.339**
	(0.0828)	(0.245)
Multi-bank x CAE	0.972**	0.642**
	(0.112)	(0.261)
Number of observations	390,485	390,485
Adj. R2	0.450	0.051
Bank Fixed Effects	√	√
Time Fixed Effects	√	√
Quintile Fixed Effects	√	√

Notes: clustered standard errors by bank in parentheses. *p<0.10, **p<0.5, ***p<0.01.

7 Conclusions

In March 2012, the Chilean government introduced a national regulation, aiming at improving the decision making of borrowers, which set a new mandatory frame to simplify the information that should be provided to consumers in the credit market.

We evaluate the impact of this informational change by exploiting a quasi-experimental environment and we explore the mechanism which can explain the results. Using detailed individual level data of all the new loans approved between 2010 and 2014, we estimate a difference-in-differences regression to assess the effect of this financial regulation on the interest rates and loan amounts.

Our findings suggest that consumers at the top 40 percent in the income distribution achieved lower interest rates after the regulation was implemented. This represents a reduction, on average, of more than 4 points in the average yearly interest rate. We find no statistically significant effects for the rest of the consumers. Also, we find no significant effects on the loan amounts. Our results are robust to several alternative specifications and placebo tests to different definitions regarding when the CAE took place.

Our findings are consistent with two possible explanations. One relies on better understanding of consumers in the highest income quintile relative to poorer borrowers, in line with the financial literacy arguments. Another explanation is that the new regulation facilitates comparisons between different banks, increasing the returns of a more active search behaviour, like quoting the same loan in more than one bank. To identify the relative weight of each of the two hypotheses, we construct the number of banking institutions that the customer has had a business relationship in the past, as a measure for individuals being more prone to quote different banking institutions. We also merge our credit data with educational outcomes for a relevant sub-sample in order to have a solid measure of financial education. Our difference-in-differences estimates including both set of covariates suggest that the hypothesis of financial literacy is the most relevant factor that could explain the effect of the new law.

We believe our results presented here are not only of interest for banking institutions or regulators, but they should also be particularly informative for public policy makers concerned with education, as well as for other countries that can learn about this financial policy, and how it can increase the positive welfare effects of this kind of banking regulations.

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APPENDIX

A Summary Statistics per Income Quintile

Table 11: Yearly Income (USD) by Quintile before and after the CAE regulation

Treatment	Yearly Income by Quintile (USD)	mean	std.dev.	cv
Before CAE	1	4,172.95	594.00	0.14
	2	6,812.23	900.84	0.13
	3	10,516.39	1.317.34	0.13
	4	17,198.8	2,868.65	0.17
	5	46,157.46	41,894.51	0.91
After CAE	1	4,319.55	615.67	0.14
	2	6,827.07	884.33	0.13
	3	10,524.29	1,336.37	0.13
	4	17,198.80	2,843.34	0.17
	5	43,592.49	34,250.60	0.78

Table 12: Age by Quintile Before and After the CAE regulation

Treatment	Yearly Age by quintile	mean	sd	cv
Before CAE	1	42.95	13.74	0.32
	2	41.09	13.49	0.32
	3	40.34	12.04	0.29
	4	41.96	11.51	0.27
	5	45.07	10.68	0.23
After CAE	1	46.84	13.74	0.29
	2	41.90	13.36	0.31
	3	40.21	12.26	0.30
	4	41.22	11.49	0.27
	5	44.31	10.72	0.24

Table 13: Default by Quintile Before and After the CAE regulation

Treatment	Default by quintile	mean	sd	cv
Before CAE	1	0.11	0.31	2.84
	2	0.13	0.33	2.32
	3	0.14	0.34	2.52
	4	0.14	0.35	2.46
	5	0.14	0.35	2.46
After CAE	1	0.15	0.36	2.37
	2	0.16	0.36	2.32
	3	0.15	0.36	2.34
	4	0.14	0.35	2.43
	5	0.13	0.33	2.61

Table 14: Loan Amount (USD) by quintile before and after the CAE regulation

Treatment	Loan Amount by Quintile (USD)	mean	std.dev	cv
Before CAE	1	1,952.06	3,033.28	1.55
	2	3,136.02	3,476.27	1.11
	3	4,664.76	4,483.44	0.96
	4	6,803.18	7,134.07	1.05
	5	13,358.98	15,581.82	1.16
After CAE	1	2,381.44	2,734.02	1.15
	2	3,649.31	3,433.69	0.94
	3	5,171.89	4,652.84	0.90
	4	7,731.19	7,549.85	0.98
	5	15,875.82	16,463.81	1.04

B First Stage Estimates

Table 15: First Stage Model 3

Dependent Variable	Interest Rate	Credit Length
TIB Banco 1	0.413	-1.018***
	(0.036)	(0.195)
TIB Banco 2	0.889***	-9.625***
	(0.170)	(0.152)
TIB Banco 3	1.363***	-0.578***
	(0.132)	(0.087)
TIB Banco 4	0.587***	0.955***
	(0.034)	(0.038)
TIB Banco 5	0.088**	-1.456
	(0.036)	(0.023)
TIB Banco 6	-0.065	-1.822***
	(0.119)	(0.071)
TIB Banco 7	-0.104	-1.429***
	(0.117)	(0.104)
TIB Banco 8	1.559***	0.542**
	(0.245)	(0.239)
TIB Banco 9	-0.288***	0.662***
	(0.019)	(0.019)
TIB Banco 10	0.121**	-0.240***
	(0.050)	(0.038)
TIB Banco 11	0.196*	-0.575***
	(0.106)	(0.056)
TIB Banco 12	0.113***	-1.514***
	(0.036)	(0.049)
TIB Banco 13	-0.336***	-0.911
	(0.056)	(0.060)
TIB Banco 14	0.054	-0.276
	(0.091)	(0.171)
TIB Banco 15	0.001	-0.048
	(0.207)	(0.118)
TIB Banco 16	1.498***	0.051
	(0.131)	(0.455)
TIB base Banco 17		
Number of observations	4,407,305	4,407,305
F Test Excluded Instruments	5.9e+08***	5.6e+08***

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