Title
Essays in Household Finance

Author
Kulkarni, Sheisha

Publication Date
2018

Peer reviewed|Thesis/dissertation

Essays in Household Finance

by

Sheisha Kulkarni

A dissertation submitted in partial satisfaction of the

requirements for the degree of

Doctor of Philosophy

in

Business Administration

in the

Graduate Division

of the

University of California, Berkeley

Committee in charge:

Professor Ulrike Malmendier, Chair
Professor Terrance Odean,
Assistant Professor Christopher Palmer,
Assistant Professor Christopher Walters

Spring 2018

Essays in Household Finance

Abstract

Essays in Household Finance

by

Sheisha Kulkarni

Doctor of Philosophy in Business Administration

University of California, Berkeley

Professor Ulrike Malmendier, Chair

This dissertation seeks to understand what components of household finance are important to consumers. In the first two chapters, we study a natural experiment in Chile where the government introduced legislation to increase financial transparency. In particular, legislation required banks to include fees in the interest rate and later to provide a standardized presentation of their loan terms. Using administrative data on the universe of consumer loans in Chile, Chapter 1 uses a regression discontinuity design to estimate the effect of this transparency reform on loan outcomes. We find that consumers are 50% less likely to default and 100% less likely to be delinquent on their loans. Further, we find that less sophisticated consumers benefited more from transparency legislation that communicated less information than legislation that presented more comprehensive information about these loans. In Chapter 2, we extend these findings and develop a dynamic structural model in order to explore the link between reduced informational frictions, price-sensitivity in consumer decisions, and welfare in long-term market equilibrium. We find that, after the policy, information frictions fell around 10 percent, which translated into an interest-rate reduction of 180 basis points. We estimate a welfare improvement for consumers of 15 percent in the long run. The last chapter uses tuition freezes on public schools in six states to examine nonprofit universities' tuition reactions to this imposed constraint on their competitor public school. Evidence from both an event study and an instrumental variables approach shows that non-profit universities do not change their prices in response to tuition freezes by comparable public schools. In contrast, for-profit universities decrease their prices by roughly $1,000. This suggests that competition between universities puts downward pressure on prices for for-profit schools but not nonprofit schools. This suggests that a important component of household spending, human capital accumulation, may become increasingly out of reach because few mechanisms cause tuition to go down.

To my (future) children.

You must have missed the come up,
I must be all I can be
Call me Mister Mufasa, I had to master stampedes
I made it through, made it through, made it through
And everything I have,
I gave to you, I gave to you, I gave to you
You got it, you got it, it's comin'
comin', comin', comin'
So are you ready?
Are you ready?
Are you ready for your blessings?

–Chance the Rapper, *Blessings*

Contents

List of Figures

List of Tables

Acknowledgments

I owe a deep debt of gratitude to both personal and professional mentors that have guided me through my dissertation. To my advisor Ulrike Malmendier who always encouraged and supported my somewhat unorthodox research program, Terry Odean whose office always felt like a safe place, and Christopher Walters who patiently drew me pictures when there was so much I didn't understand. Thanks to my coauthors Santiago Truffa and Gonzalo Iberti, without whom this dissertation would not have been possible. I would also like to thank the professors at McGill who encouraged my development and pursuit of graduate school. Special thanks to Jason Allen, Andrew Usher, Kim Hyunh and Evren Damar who made my time at the Bank of Canada an enriching experience and offered me my first taste of the academic community.

I thank my family for financially and emotionally supporting me through the many trials and tribulations of my career thus far. While too many to name, I also thank all my Haas and Economics classmates who taught me so much and were a crucial source of support. I also thank my friends outside the PhD program, without whom I would have been an insane brain on a stick. I would be remiss (and probably divorced) if I didn't thank my husband for all his emotional support and conviction in me and my research. I love you more than the salt in my food.

Lastly, I would like to thank Christopher Palmer. If I become a quarter of either the human or scholar he is, I will die a happy person. I have learned so much about being an academic and an upstanding human through his guidance and his actions. At every stumble, he never failed to pick me up, brush me off, and send me on my way with confidence. But most of all, he taught me to believe in myself through his belief in me. I would not be where I am today without him.

Chapter 1

Information Frictions and Consumer Financial Regulation

Abstract[1]

We study a natural experiment in Chile where the government introduced legislation to increase financial transparency. In particular, the legislation required banks to include fees in the interest rate and later to provide a standardized presentation of their loan terms. Using administrative data on the universe of consumer loans in Chile, we use a regression discontinuity design to estimate the effect of this transparency reform on loan interest rates. We find that consumers are 50% less likely to default and 100% less likely to be delinquent on their loans. Further, we find that less sophisticated consumers benefited more from transparency legislation that communicated less information than legislation that presented more comprehensive information about their loans.

1.1 Introduction

Firms may put important information in fine print. If consumers are fully rational, they should be able to recover the relevant information required to make decisions from this fine print. However, research in health care, loans, mutual funds, and other investment products Handel 2013; "Product Differentiation, Search Costs, and Competition in the Mutual Fund Industry: A Case Study of S&P 500 Index Funds"; Christoffersen and Musto 2002; Luco 2013; Bergstresser, Chalmers, and Tufano 2009; Green, Hollifield, and Schürhoff 2006; Brown, Hossain, and Morgan 2010; Argyle et al. 2016; Woodward and Hall 2010; Baye and Morgan 2001; Baye, Morgan, and Scholten 2006, suggests that consumers are not able to glean the relevant information and as a result, select products that may not be what they would have chosen rationally.

[1]This research received financial support from the Alfred P. Sloan Foundation through the NBER Household Finance small grant program.

To combat this, legislations and organizations have been created to assist consumers. For example, in the United States, the Truth in Lending Act requires the disclosure of the interest rate expressed in APR with all fees included for a product. In addition, in 2011, the Consumer Financial Protection Bureau was created to investigate and punish firms for treating consumers unfairly. However, there has been little documented evidence examining the effect of financial disclosure on consumers outcomes, and more importantly, how consumers may differ in their reactions to disclosure.

We study financial regulations that increased the transparency of otherwise hidden fees for consumer loans in Chile and assess their impacts on borrower outcomes. We exploit the introduction of two different financial disclosures to answer these questions: the first, the "simple" disclosure introduces a measure similar to APR and required lenders to display it when making loans, and was applied to loans below a certain size and maturity. The second, the "complex" disclosure displayed the APR equivalent in addition to other information such as the total amount paid back, the monthly payments, fees, etc. that was applied to all loans a year after the "simple" legislation was introduced.

Using a regression discontinuity design on the loan size cutoff, we find that the "simple" disclosure reduced delinquency by 50% (14 percentage points on an average of 30% delinquency rates) and can almost completely eliminate default. However, this is a local treatment effect for fairly large borrowing amounts. Using an interrupted time series, we compare how sophisticated and unsophisticated borrowers react differentially to the simple and complex disclosure. We find that unsophisticated borrowers benefit (i.e. are delinquent less often) from the simplified disclosure, but do not benefit further from more complex disclosure. By contrast, sophisticated borrowers did not seem to benefit from simple disclosure, suggesting they had already calculated their own APR equivalent. However, they do benefit from more complex disclosure, suggesting the further information helped them select the financial option that was best for them.

Section 1.2 surveys the existing literature about financial disclosure, section 1.3 describes the Chilean financial system including key features that we exploit in our identification and the legislative changes we examine. Section 1.4 presents our data, while section 1.5 describes our results including our regression discontinuity and interrupted time series analysis. We also use the interrupted time series to examine mechanisms for hw borrowers might be reacting to the legislation to default less often. Lastly, section 1.7 concludes.

1.2 Literature Review

There is a somewhat limited and mixed literature on the outcomes of consumer financial disclosure regulations. This is predominantly because well-identified experiments are difficult to come across as many are implemented at the national level and often do not have a control group. Additionally, there exists a reluctant climate for progressive consumer financial regulation, so there are a limited number of changes to take advantage of. Perhaps the seminal paper in the literature, Bertrand and Morse 2011 show that if consumers of payday

loan companies are informed about the actual interest rate of their loan amount, they are less likely to take out a payday loan and take out a lower amount. Agarwal et al. 2014a find that after the introduction of various payment 'anchors' on credit card statements, consumers made small but significant changes to their payment schedules. However, Palmer et al. (2017) find that people do not change their savings account choices even if they are told they could sign up for a better savings account.

Thus far, the most applicable results come from the literature on Medicare, specifically Part D. Here, one part of the premium is easily identifiable, while the other requires additional research. Kling and colleagues Kling et al. 2008 conduct a randomized control trial where they inform consumers about both costs and find that people are more likely to switch and save $90 on average. Furthermore, Abaluck and Gruber Abaluck and Gruber 2011 estimate consumer elasticities to both the overt and hidden premium. Applying the overt price elasticity to the hidden premium implies that welfare would be 27% higher if everyone chose rationally.

We are optimistic that our data and experiment can provide more accurate estimates than previously exist in the literature. First, many of these studies are only able to sample a few lenders, while we see the universe of banks in the country. Secondly, bank-level changes in disclosure are sometimes viewed suspiciously by consumers and therefore ignored. Since our exogenous variation comes from a trusted governmental agency, we believe that consumers are more likely to trust and respond to the information provided in the disclosure. Lastly, to our knowledge, no study is able to follow borrowers to assess match quality between borrower and lender. We receive bi-weekly updates on the status of the loan and can assess if the disclosure resulted in fewer defaults and/or renegotiations of the loan terms.

1.3 Chilean Financial System

Chile offers an ideal environment to assess the implications of financial regulation for developed countries. It is the richest country in South America with a GDP of $13,792 USD per capita (World Bank). Financial services account for 4.2% of GDP as compared to 7.4% in the United States (OECD**). As of 2014, 63% of adults had an account at a financial institution as compared to 94% in the United States and other high-income OECD countries (World Bank). These measures suggest that Chile offers a reasonable laboratory to extrapolate our conclusions to other high-income countries.

Consumer loans make up 36.7% of GDP in Chile, as compared to 17.5% in the United States. However, if you include US home equity lines of credit, which are used for similar purposes as consumer loans in Chile, US consumer loan debt is 21% of GDP.

The banking system in Chile has a number of large national banks as well as a number of smaller institutions. BancoEstado is a state-backed bank, though operates as a for-profit entity. Once given a RUT number (national ID number), citizens are given a bank account that matches their RUT at BancoEstado.

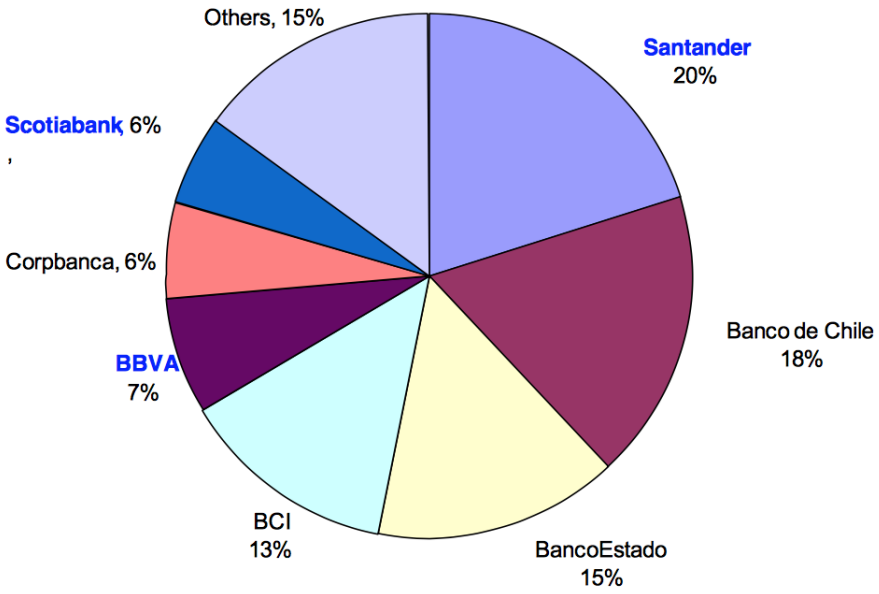


Figure 1.1: 2008 Chile Bank composition: OECD/Central Bank of Chile

However, Chile differs substantially from the United States in that their financial literacy rate is roughly half that of the United States: 16% versus 34% (National Student Survey, 2012). This is part of the motivation for why these financial regulations were enacted to help consumers better understand their products. Thus, while the estimates we have might overestimate the effectiveness of financial regulation, if these regulations are effective in Chile, it might suggest they would also be effective for at-risk U.S. populations.

While the average interest rate in our sample may seem high, it is consistent, and even on the low end, with interest rates on consumer debt in other Latin American countries. For example, credit card interest rates in Mexico are between 35 and 700% APR and average credit card rates in Brazil are between 58 and 700%. Venezuela and Costa Rica have average rates of 29% and 32% respectively. For consumer credit, Panama has an average rate of 9.18%, while Argentina's is 34.5% APR.

Currency

An important note before discussing the regulatory environment in Chile is to explain how loans are structured. While purchases are conducted in pesos, loans are denominated in UF. The UF is an inflation-indexed currency, putting the burden of inflation risk on the consumer. For reference, Table 1.1 presents conversion rates for pesos, UF, and USD:

RATES ARE VALID FOR 2 WEEK INTERVALS

Table 1.1: Conversion Rates as of January 1st, 2018

	Peso	USD
USD	615	1
UF	26,795	43

Regulatory Changes

After the 2008 financial crisis, much emphasis was placed on international agencies and national governments to design policies that provided more protection to financial consumers. Reforming the National Consumer Service so that it could intervene in consumer credit markets, represented one of the fundamental campaign promises made by President Sebastian Pinera. In 2009 alone, the National Consumer Service received approximately 328,000 queries and 170,000 claims. Of the latter, 27 percent corresponded to the financial services and insurance sector. The government attributed part of the problem to the fact that

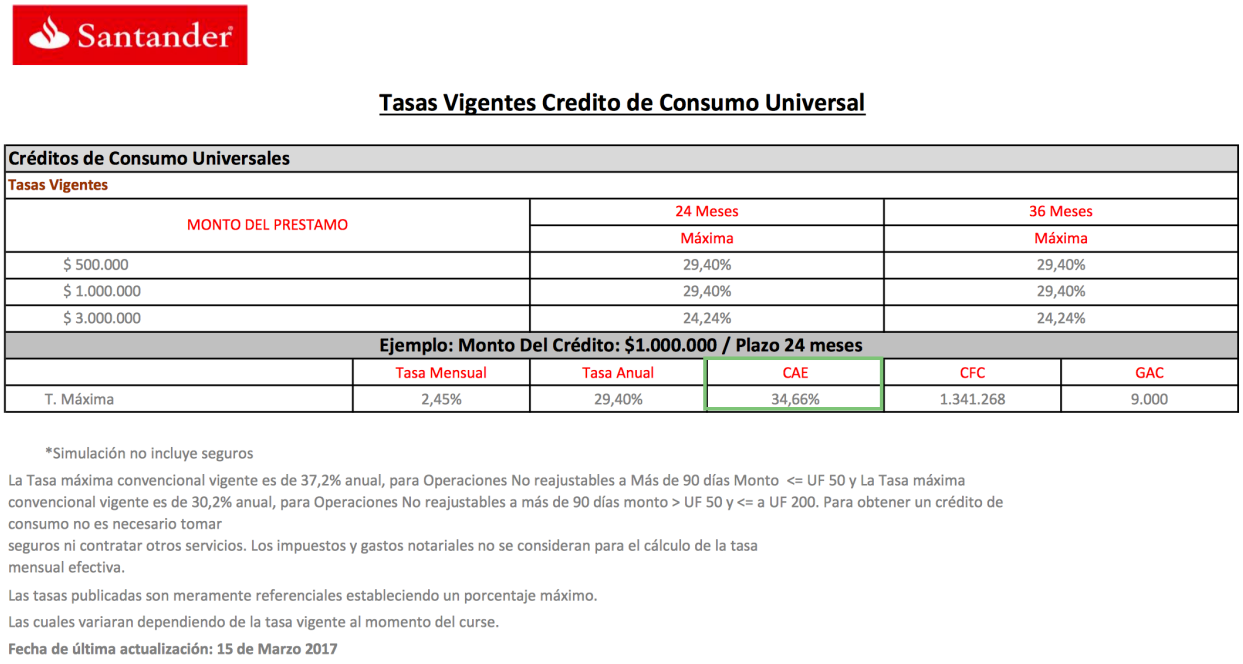
> Financial service providers have not always prioritized their duty to adequately inform consumers so that they can freely decide with whom they should contract. Financial institutions are not providing transparent information to allow consumers to effectively evaluate and compare the costs associated with a credit, like interest rate, commissions and exit costs associated with the termination of the contract.

In response, the Chilean government introduced two laws – Law 20.448 and 20.555 – to regulate and standardizing how relevant information should be presented to consumers. We will summarize these two laws in the following sections.

CAE: Law 20.448

The first consumer financial regulatory change was announced in December 16, 2010 and implemented on October 24, 2011. It created an "annual charge indicator" (CAE) that expresses the cost of credit as an annual period. This number wrapped up all the fees that would be included in the loan and added them to the interest rate to represent a true cost of credit. While we do not have data on the separate fees and interest rates, Chilean loans are structured such that fees substantially change monthly payments. An example of loan contract can be seen in Figure 1.2, where there is an almost 500 basis point difference between the interest rate (tasa annual) and the CAE.

As this regulation was implemented to protect 'unsophisticated' consumers, there was a cutoff to loan offers that would display CAE. Consumer loans above 1,000 UF (roughly $40,000 USD) would be exempt from these requirements as they would go to 'sophisticated' consumers. Thus, loans below 1,000 UF would be subject to a transparent regime where all



Santander

Tasas Vigentes Credito de Consumo Universal

Créditos de Consumo Universales					
Tasas Vigentes					
MONTO DEL PRESTAMO		24 Meses		36 Meses	
		Máxima		Máxima	
$ 500.000		29,40%		29,40%	
$ 1.000.000		29,40%		29,40%	
$ 3.000.000		24,24%		24,24%	
Ejemplo: Monto Del Crédito: $1.000.000 / Plazo 24 meses					
	Tasa Mensual	Tasa Anual	CAE	CFC	GAC
T. Máxima	2,45%	29,40%	34,66%	1.341.268	9.000

*Simulación no incluye seguros

La Tasa máxima convencional vigente es de 37,2% anual, para Operaciones No reajustables a Más de 90 días Monto <= UF 50 y La Tasa máxima convencional vigente es de 30,2% anual, para Operaciones No reajustables a más de 90 días monto > UF 50 y <= a UF 200. Para obtener un crédito de consumo no es necesario tomar
seguros ni contratar otros servicios. Los impuestos y gastos notariales no se consideran para el cálculo de la tasa mensual efectiva.

Las tasas publicadas son meramente referenciales estableciendo un porcentaje máximo.

Las cuales variaran dependiendo de la tasa vigente al momento del curse.

Fecha de última actualización: 15 de Marzo 2017

Figure 1.2: Law 20.448 Sample Quote Sheet

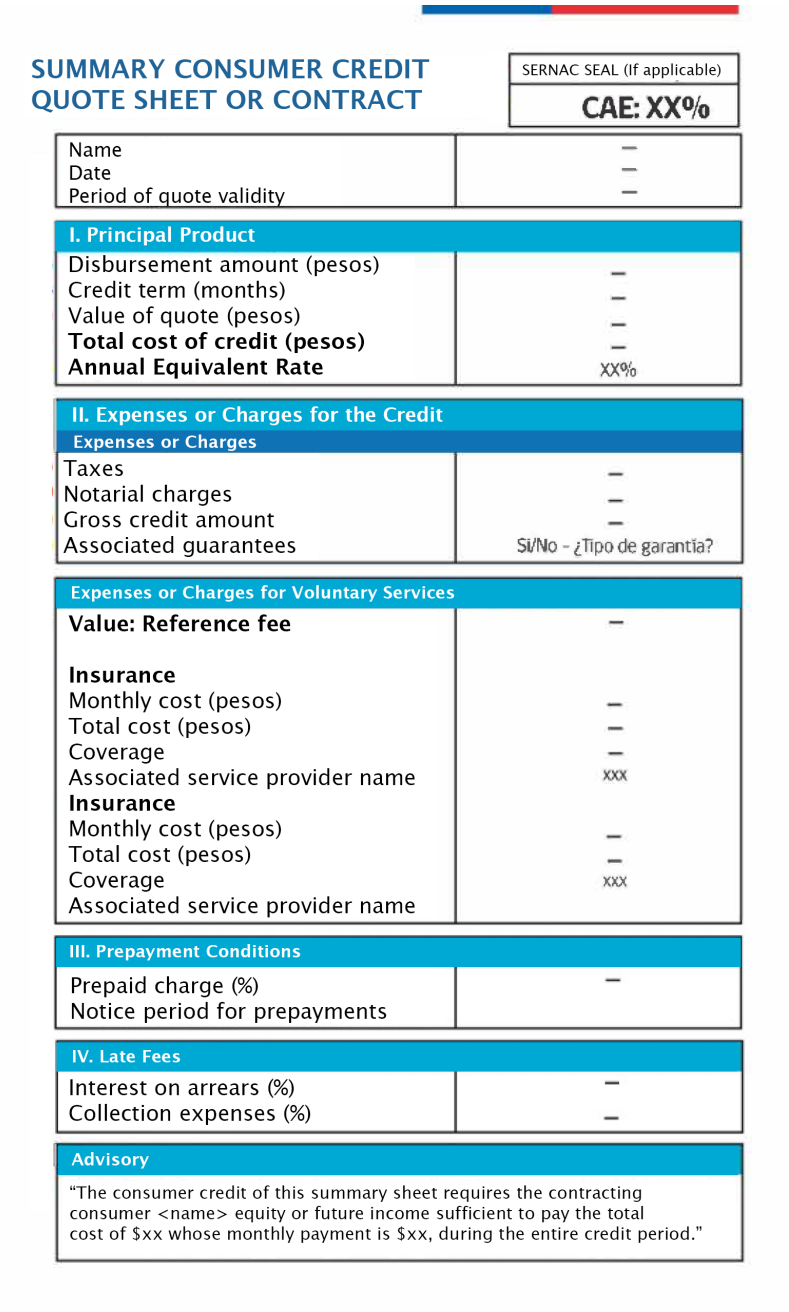
fees would be included in a CAE that could be compared with the interest rate, while loans above the cutoff would be under an opaque regime that was similar to the prior period.

SERNAC: Law 20.555

The second legislation to be introduced was the SERNAC Financiero regulations. SERNAC Financiero is the consumer finance advocate in Chile, the rough equivalent to the Consumer Financial Protection Bureau in the United States. Based on the introduction of the CAE legislation, further legislation was developed to help consumers better understand loan terms. This legislation was announced in March 14 2012 and implemented July 31 2012. It created a standardized loan disclosure document where in addition to the CAE, a consumer would see their monthly payment and the total amount including all interest that they would have to pay back to borrow a certain amount of money. The blue box in Figure 1.2 shows the new loan contracts that would have been shown to consumers. Note that most of the information in SERNAC –namely, the principle product and expenses –could be computed using CAE and the loan term.[2] This additional disclosure was created explicitly to reduce informational frictions between borrowers and lenders. As the Ministry of Finance stated in the law,

[2]The only completely new information concerned contingent fees – prepayment and late fees – that could still be hidden in the fine print under CAE.

> We have noted the existence of informational asymmetries in the financial services market for individuals, where the current attributions of the National Consumer Service (SERNAC) have not been sufficient to resolve them. Therefore, we consider it essential to strengthen the consumer protection of financial services, through the allocation of greater powers and competencies to SERNAC, improving the delivery of information and carrying out studies that reduce information asymmetries.



SUMMARY CONSUMER CREDIT QUOTE SHEET OR CONTRACT

SERNAC SEAL (If applicable)

CAE: XX%

Name	–
Date	–
Period of quote validity	–
I. Principal Product	
Disbursement amount (pesos)	–
Credit term (months)	–
Value of quote (pesos)	–
Total cost of credit (pesos)	–
Annual Equivalent Rate	XX%
II. Expenses or Charges for the Credit	
Expenses or Charges	
Taxes	–
Notarial charges	–
Gross credit amount	–
Associated guarantees	Si/No - ¿Tipo de garantía?
Expenses or Charges for Voluntary Services	
Value: Reference fee	–
Insurance	
Monthly cost (pesos)	–
Total cost (pesos)	–
Coverage	–
Associated service provider name	xxx
Insurance	
Monthly cost (pesos)	–
Total cost (pesos)	–
Coverage	xxx
Associated service provider name	
III. Prepayment Conditions	
Prepaid charge (%)	–
Notice period for prepayments	
IV. Late Fees	
Interest on arrears (%)	–
Collection expenses (%)	–

Advisory

"The consumer credit of this summary sheet requires the contracting consumer <name> equity or future income sufficient to pay the total cost of $xx whose monthly payment is $xx, during the entire credit period."

Figure 1.3: Example of Law 20.255 Disclosure Sheet (English translation)

1.4 Data

We obtain our data from the Superintendencia de Bancos e Instituciones Financieras (SBIF), which is the banking regulator for Chile.

To construct our sample, we start with an initial sample size of 7,655,263 representing 95% of the consumer loans in Chile. We drop all loans that do not go to Chilean citizens or that have missing observations for any of our control variables. This leaves us with a final sample of 6,331,545 unique loan observations.

We have a sample of administrative consumer loan data of roughly 6.8 million consumer loans between January 1, 2009 and December 31, 2014. This represents roughly 95% of the population of consumer bank loans over that time period. Consumer loans in Chile are generally unsecured (though there can be exceptions) and can be thought of as a way to purchase durable goods, cars, conduct home improvements, etc.

Table 1.2 presents summary statistics for our main variables broken out by the three regulatory periods. Our main dependent variable, interest rate, grows over time from a mean of 19% to a mean of almost 30%, through this could be due to loan amount growing over time from 130 UF to an average of 113 UF. Our demographic characteristics like fraction of females, age, and married customers are fairly constant over the period as well, with slightly less than half of borrowers being female with an average age of 44 and roughly 60-70% of borrowers are married. Credit risk is an indicator from zero to one that represents the fraction of each loan a consumer has that is set aside by the bank as a loan reserve. On average based on the median consumer, 8-10% of consumer loans are provisioned for future losses. The more a bank provisions against a customer, the riskier they are perceived to be. Annual income is very variable over this period as well, which could explain the loan fluctuations.

Table 1.2: Summary Statistics

	N	p25	Mean	Median	p75	SD
Ever Delinquent		0.00	0.26	0.00	1.00	0.44
Ever Defaulted		0.00	0.01	0.00	0.00	0.08
Ever Extended		0.00	0.20	0.00	0.00	0.40
Rate		13.20	24.58	20.13	35.28	13.86
Mat. at Issue		12.00	24.69	25.00	37.00	17.25
Loan Size (UF)		20.58	117.41	54.01	144.46	170.90
Female		0.00	0.42	0.00	1.00	0.49
Age		33.00	44.34	43.00	54.00	13.51
Credit Score		0.03	0.12	0.08	0.13	0.16
Income (UF)		10.71	563.21	89.34	343.59	220,596.56
Married		0.00	0.65	1.00	1.00	0.48
Total No. Loans		2.00	5.72	4.00	7.00	6.84
No. Outst. Loans		1.00	3.46	2.00	4.00	4.33
Outst. Debt (UF)		25.09	138.59	66.35	166.05	204.43
Future Debt (UF)		0.00	236.66	49.15	241.13	516.56
Observations	6,331,545					
Switched Banks		0.00	0.48	0.00	1.00	0.50
Switched to New Bank		0.00	0.36	0.00	1.00	0.48
Observations	2,327,287					

1.5 Regression Discontinuity

The implementation of law 20.448 provides a unique opportunity to test our hypotheses. Because the law placed requirements on all and only loans below 1,000 UF (about $50,000 USD) for consumer credit, we can use a regression discontinuity design to identify the effects of removing cognitive costs. Specifically, we can compare the interest rate (including fees), maturity, and performance (e.g. default and delinquency rates) of loans just below and just above the limit. Because these loans should otherwise be comparible, we can attribute any differences to the removal of cognitive costs. We can also examine whether loans bunch around the regulatory limits before and after the law change to determine whether lenders make loans strategically to evade the regulation. While this may be well-identified, it does represent only a local treatment effect. To determine the effect of these regulations on the target population of less-well off borrowers, we require a more structural approach explored in the next section.

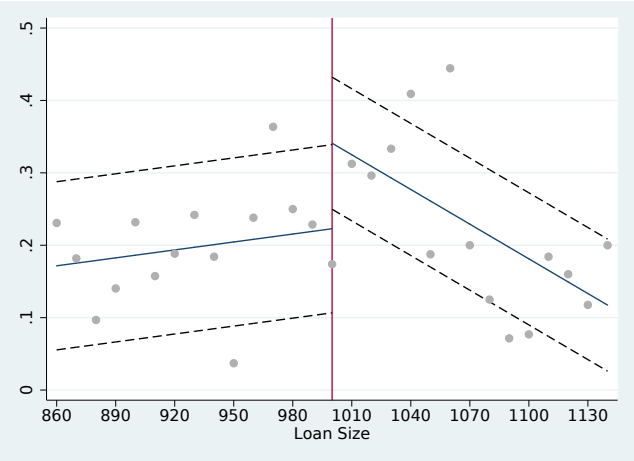


Figure 1.4: Raw Regression Discontinuity

$$\begin{aligned} y_{it} =& \alpha + \beta_1 Loansize_{it} + \beta_2 \mathbb{1}_{\{Loansize_{it}<1000\}} \\ &+ \beta_3 \mathbb{1}_{\{Loansize_{it}<1000\}} Loansize_{it} + \gamma X_{it} + \epsilon_{it} \end{aligned}$$

We use lender id, comuna, and credit risk variables as our control variables.

RD Loan Size Results

Using the loan size cutoff, we find that the probability of being delinquent decreased by 14 percentage points. Given the mean delinquency probability of these loans is 34.1%, this represents a roughly 50% decrease in the probability of a borrower ever missing a payment. Similarly, with a 1.6 percentage point decrease in defaults on a mean of 1.7%, this disclosure reduced by 100% the percentage of borrowers defaulting on loans. Since one in three loans in our sample has their maturity extended, the reductions in defaults and delinquencies may be due to banks being more likely to extend loans that may have otherwise been delinquent or default. However, our results suggest that loans above and below the cutoff were not extended differentially, suggesting that these were true improvements rather than window dressing.

Examining other borrower outcomes, we find that borrowers miss $\frac{1}{2}$ of a payment less, and have missed payments reduced on average by 31 UF (equivalent to $1,200 USD). We do not find that these borrowers default sooner, which might suggest that defaults were due to misunderstandings in the loan contract. These improvements in borrower outcomes do not subsequently impact the future credit these borrowers subsequently take out. However, these tend to be very wealthy borrowers and so potentially experience little difficulty taking out credit generally.

	(1) Ever Delinquent	(2) Ever Defaulted	(3) Ever Extended
Transparency	-0.144**	-0.0161**	0.00413
	(0.0711)	(0.00809)	(0.0311)
Loan Size	-0.148**	-0.00604	-0.000818
	(0.0623)	(0.00796)	(0.0328)
Transparency X Loan Size	0.163*	-0.00175	0.0189
	(0.0861)	(0.00943)	(0.0389)
Comuna Fixed Effects	Y	Y	Y
Lender Fixed Effects	Y	Y	Y
Bandwidth	138	153	131
Kernel	Tri	Tri	Tri
Mean	.341	.017	.034
N	1088	1183	1033

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 1.3: Regression Discontinuity

	(1) Month Default	(2) # Miss. Pmnts	(3) $ Miss. Pmnts	(4) Future debt
Transparency	0.419	-0.413**	-31.70**	284.0
	(4.584)	(0.196)	(15.61)	(212.1)
Loan Size	2.907	-0.335**	-25.77	356.2
	(9.208)	(0.153)	(17.70)	(245.2)
Trans. X Loan Size	-1.162	0.294	24.73	-289.6
	(10.17)	(0.191)	(20.06)	(316.3)
Comuna FE	Y	Y	Y	Y
Lender FE	Y	Y	Y	Y
Bandwidth	87	187	132	127
Kernel	Tri	Tri	Tri	Tri
Mean	7.141	.795	55.365	652.741
N	110	1369	1038	1005

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 1.4: Regression Discontinuity, Other Credit Outcomes

	(1) Ever Defaulted	(2) Ever Delinquent	(3) Ever Extended
Transparency	-0.118*	-0.0194	-0.0118
	(0.0706)	(0.0141)	(0.0275)
Loan Size	-0.160**	-0.0107	-0.00983
	(0.0662)	(0.0141)	(0.0307)
Transparency X Loan Size	0.196**	0.00587	0.0184
	(0.0841)	(0.0145)	(0.0360)
Comuna Fixed Effects	N	N	N
Lender Fixed Effects	N	N	N
Bandwidth	138	153	131
Kernel	Tri	Tri	Tri
Mean	.341	.017	.034
N	1088	1183	1033

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 1.5: Raw Regression Discontinuity

Robustness Checks

Table 1.5 shows the results of the raw regression discontinuity without any controls. Here we see that the discontinuity is significant at the 10% level, though adding controls for characteristics about the loans substantially reduces the noise around the cutoff, allowing us to find significant results. Table 1.5 adds controls for outstanding debt, number of outstanding loans, and leverage (debt/income). We are heartened to see that this increases the magnitude of our RD coefficient. In tables 1.5 1.5 show the RD in the pre and post period of the regulatory change. While there is a slight negative significance in the pre-period, the post-period when all loans were subject to this disclosure is insignificant. Lastly, we conduct placebo cutoff tests at 1040 UF and 1070 UF in tables 1.5 and 1.5. We find that the cutoff is not significant in the 1040 UF case and while significant in the 1070 UF case, it goes in the opposite direction. It is reasonable to expect that the 1070 UF case may be significant as this may suggest that banks price according to rules of thumb.

	(1) Ever Defaulted	(2) Ever Delinquent	(3) Ever Extended
Transparency	-0.169**	-0.0203**	-0.0000357
	(0.0768)	(0.0103)	(0.0318)
Loan Size	-0.173***	-0.00991	-0.0118
	(0.0595)	(0.00948)	(0.0234)
Transparency X Loan Size	0.159*	0.00435	0.0290
	(0.0859)	(0.0121)	(0.0296)
Comuna Fixed Effects	Y	Y	Y
Lender Fixed Effects	Y	Y	Y
Bandwidth	150	174	201
Kernel	Tri	Tri	Tri
Mean	.298	.024	.048
N	957	1045	1157

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 1.6: Regression Discontinuity with Additional Controls

	(1) Ever Defaulted	(2) Ever Delinquent	(3) Ever Extended
Transparency	-0.0556*	0.00432	0.00975
	(0.0289)	(0.00362)	(0.0153)
Loan Size	-0.0351	0.000754	0.00737
	(0.0458)	(0.00148)	(0.0223)
Transparency X Loan Size	-0.0394	0.00594	0.00379
	(0.0548)	(0.00774)	(0.0279)
Comuna Fixed Effects	Y	Y	Y
Lender Fixed Effects	Y	Y	Y
Bandwidth	125	71	136
Kernel	Tri	Tri	Tri
Mean	.129	0	.046
N	3059	2247	3248

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 1.7: Regression Discontinuity, Pre-period

	(1) Ever Defaulted	(2) Ever Delinquent	(3) Ever Extended
Transparency	-0.0254	-0.00779*	0.00434
	(0.0197)	(0.00454)	(0.00853)
Loan Size	0.0262	-0.000639	0.0120
	(0.0223)	(0.00899)	(0.00807)
Transparency X Loan Size	-0.0570*	-0.0142	-0.0148
	(0.0291)	(0.0126)	(0.00948)
Comuna Fixed Effects	Y	Y	Y
Lender Fixed Effects	Y	Y	Y
Bandwidth	145	93	181
Kernel	Tri	Tri	Tri
Mean	.081	.003	.015
N	4436	2282	5703

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 1.8: Regression Discontinuity, Post-period

	(1) Ever Defaulted	(2) Ever Delinquent	(3) Ever Extended
Transparency	0.150	-0.0249	0.00364
	(0.0969)	(0.0245)	(0.0270)
Loan Size	-0.123	-0.0317	-0.00471
	(0.112)	(0.0277)	(0.0216)
Transparency X Loan Size	0.424***	0.0364	0.0151
	(0.147)	(0.0272)	(0.0262)
Comuna Fixed Effects	Y	Y	Y
Lender Fixed Effects	Y	Y	Y
Bandwidth	116	152	171
Kernel	Tri	Tri	Tri
Mean	.282	.025	.03
N	639	1096	1176

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 1.9: Regression Discontinuity, Placebo Cutoff (1040 UF)

	(1) Ever Defaulted	(2) Ever Delinquent	(3) Ever Extended
Transparency	0.220**	0.00955	-0.0134
	(0.103)	(0.0111)	(0.0310)
Loan Size	0.0901	-0.0102	-0.0257
	(0.114)	(0.00848)	(0.0366)
Transparency X Loan Size	0.0163	0.0278	0.0228
	(0.161)	(0.0205)	(0.0483)
Comuna Fixed Effects	Y	Y	Y
Lender Fixed Effects	Y	Y	Y
Bandwidth	121	139	136
Kernel	Tri	Tri	Tri
Mean	.126	.005	.038
N	573	657	637

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

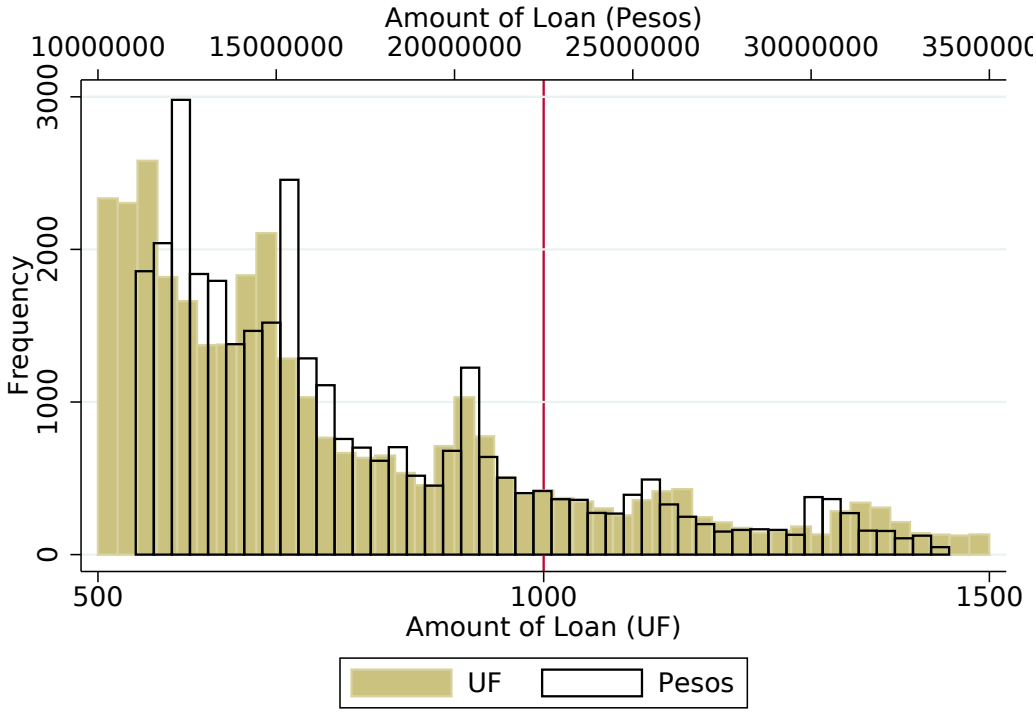
Table 1.10: Regression Discontinuity, Placebo Cutoff (1070 UF)

In a regression discontinuity, there are two threats to identification. The first is that consumers may be able to manipulate their loan size above and below the cutoff, suggesting that these results are due to selective bunching of borrowers rather than due to the disclosure. As explained in section 1.5, due to the conversion between pesos and UF, this bunching is not observed in our sample. Secondly, we may worry that either banks or consumers would screen borrowers on different qualities above and below the cutoffs, such that our result would be based on this selection and not the disclosure. Our results in section 1.5 show that none of our control variables show discontinuities that are significant at the 5% level.

Manipulation of Loan Size

One might be worried that given the regulation was common knowledge, consumers and lenders might try to manipulate loan amounts to get around the provisions of the CAE legislation. For example, lenders may encourage borrowers to borrow slightly larger loans so they did not have to display the CAE number, or consumers may have taken out multiple smaller loans in order to take advantage of comparison shopping with CAE. We conduct a McCreary density test to ensure that this was not the case.

However, before we conduct the McCreary density test, we present some raw data that suggests this was unlikely to be the case. As described in Section 1.3, purchases are conducted in pesos, while loans are transacted in UF. The exchange rate between pesos and UF fluctuates daily—therefore, if a consumer wanted to purchase a specific object or wanted to borrow a specific amount in pesos, this may be above the UF cutoff one day and below the next. This is seen in Figure 1.5 where there is clear bunching at round peso amounts in loan sizes, but there is a much smoother distribution and less concentrated around round numbers in UFs. Figure 1.5 shows the McCreary density test and results that show the loan



size in UF does not seem to bunch at either side of the cutoff.

Covariates

We replicate the discontinuity regression for all our control variables. We find that for almost all variables, there is no significance at the 10% level of any discontinuities at 1,000 UF. This includes variables you might be worried that borrowers or the banks might sort on including income and credit risk. The only variable that is significant, expected inflation, is mostly mechanical as when rates between pesos and UF increase, then it requires more pesos to make 1 UF, making it more likely that the loan will be below the cut-off when the exchange rate is low.

To summarize, we find that borrowers are 50% less likely to miss a payment on their loans, almost eliminate default, and reduce missed payments by approximately $1,000 USD. However, these results are local to borrowers that are taking out loans of $40,000 USD, who are not the borrowers policy makers had in mind when crafting these legislative changes. We now turn to examine heterogenous impacts of borrowers that were affected by both the simple and complex policy changes.

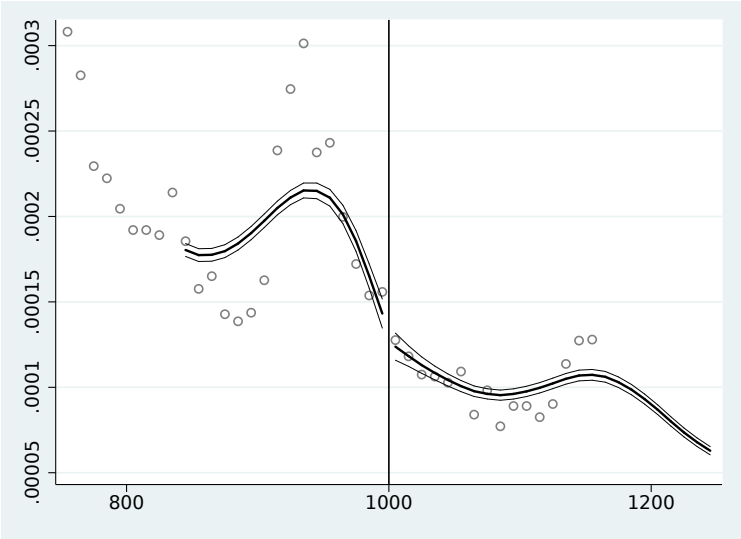
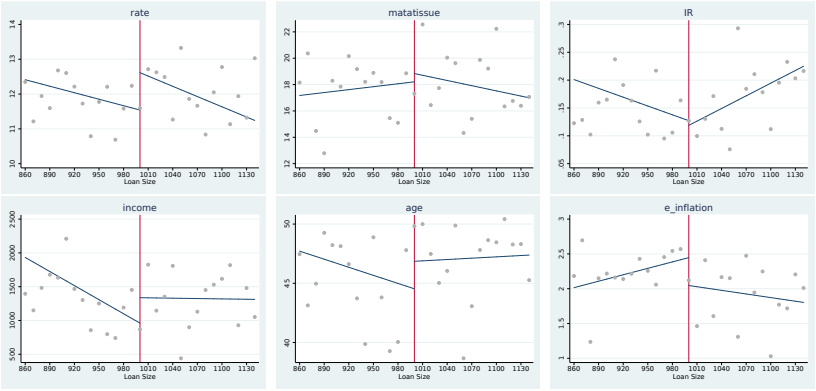


Figure 1.5: Discontinuity estimate: -0.4 (0.05)

	(1) Interest Rate	(2) Maturity	(3) Credit Risk	(4) Income	(5) Age	(6) Expected Inflation
Transparency	-0.759	-1.292	0.000430	-326.2	-3.096	0.368*
	(0.508)	(1.228)	(0.0311)	(241.5)	(2.143)	(0.217)
Loan Size	-0.367	-1.586	0.0769**	1.744	0.661	-0.195
	(0.464)	(1.195)	(0.0310)	(232.7)	(1.789)	(0.206)
Trans. X L. Size	-0.264	2.289	-0.141***	-623.8*	-4.004	0.469*
	(0.618)	(1.526)	(0.0400)	(342.1)	(2.513)	(0.262)
Comuna FE	Y	Y	Y	Y	Y	Y
Lender FE	Y	Y	Y	Y	Y	Y
Bandwidth	138	138	138	138	138	138
Kernel	Tri	Tri	Tri	Tri	Tri	Tri
Mean	13	19	0	1337	47	2
N	1088	1088	1088	1088	1088	1088

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$



1.6 Interrupted Time Series

We divide borrowers into three different groups: the first, which we call "unsophisticated" lives in a neighborhood that has less than the modal level of education (in our case, the average education across the comuna has some high school education, but did not complete high school). The second, our control group, has roughly graduated high school (one year short of graduation to graduated high school), and the last group, which we consider our "sophisticated" borrowers has more than a high school level of education. Below we document the number of loans that fall into each category (Figure 1.11.

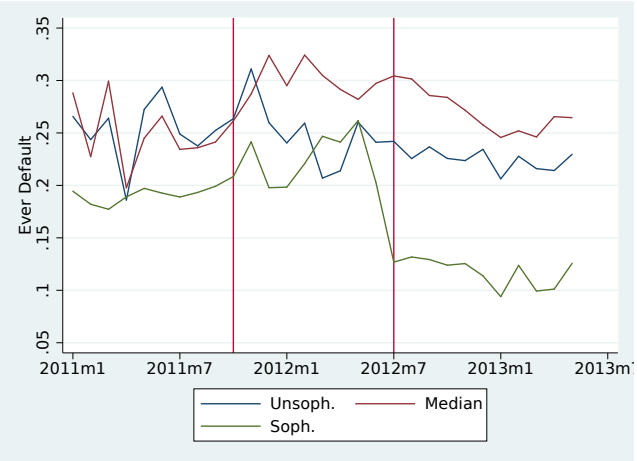
We collapse the history of the loan into a single data point, retaining the information about the loan at origination and whether the loan is ever delinquent, ever defaults, or is ever extended. We restrict our sample to loans that have maturities of less than 24 months so as to avoid a subsequent legislation introducing an interest rate cap in 2014 and to ensure that we use the full history of the loan.

We then run the following regression twice: once to compare the unsophisticated borrowers with the control group and the second to compare sophisticated borrowers with the control group.

$$y_i = \alpha_t + \beta_t \times \mathbb{1}_{\{Unsoph_i\}} + \gamma X_i + \epsilon_i \tag{1.1}$$

Sophistication	Frequency	Percent	Cum
¡12 years school	1,055,235	41.88	41.88
12 years school	1,340,548	53.21	95.09
¿12 years school	123,757	4.91	100.00
Total	2,519,540	100.00	

Table 1.11: Number of Observations by Sophistication



The coefficients of interest are time dummies interacted with either the sophisticated or unsophisticated dummy variables, representing the treatment effect of being either a sophisticated or unsophisticated borrower by month. We use minimal controls in this specification (age, married, sex, expected inflation, interbank rate, and neighborhood fixed effects), as we will use previous control variables like income and credit risk to evaluate if this disclosure subsequently resulted in borrower selection in debt take up.

Figures 1.6 and 1.7 show the results of equation (1.1) on both sophisticated and unsophisticated borrowers. We see that unsophisticated borrowers experience a reduction in delinquency after the introduction of the simple credit legislation, but are not additionally helped by the more complex disclosure sheet introduced in 2012. In contrast, more sophisticated borrowers do not seem to benefit from the simplified CAE disclosure. However, they did experience a decrease of ten percentage points when the more complex disclosure was introduced.

Different types of financial disclosure therefore have heterogeneous effects across different populations. Unsophisticated borrowers substantially benefit when they are presented with a single number, which wraps up fees and the total charges that would otherwise be hidden in the fine print. This suggests that unsophisticated borrowers were previously either unaware that additional fees may be in the fine print or that they lacked the attentional bandwidth to locate those fees and include them in their financial decision making. Unsophisticated borrowers gain no additional benefit when presented with a sheet that contains much more information on the breakdown of costs and fees associated with the loan. Although these borrowers do not lose the benefits they gained from the previous legislation, this is likely because the more complex disclosure still displays the simplified APR terms in a prominent typeface and position in the disclosure (figure 1.3). One plausible interpretation of this result is that lower educated borrowers were overwhelmed by the complex disclosure, and did not incorporate this extra information into their decision-making process. Our results therefore suggest that unsophisticated consumers benefit only from a simplified financial disclosure,

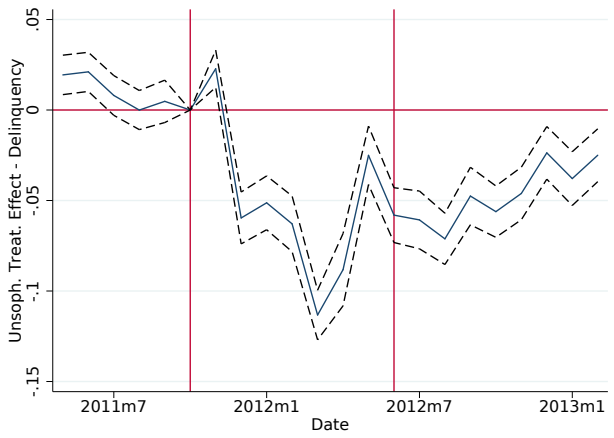


Figure 1.6: Unsophisticated borrowers do best under simplified disclosure.

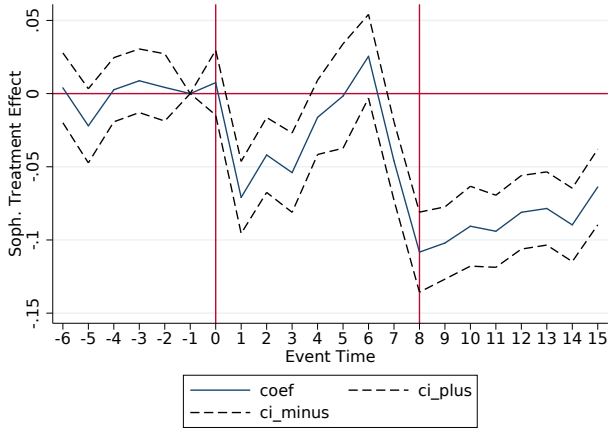


Figure 1.7: Sophisticated borrowers do best with more complex disclosure.

which encourages them to focus on and compare a single number across loan terms.[3]

Sophisticated borrowers do not benefit from the simplified regulation. In contrast to unsophisticated borrowers, sophisticated borrowers therefore seem to already incorporate "hidden fees" into their financial decision making. Furthermore, sophisticated borrowers reduced their default rates by 10 percentage points after the introduction of the more complex SERNAC disclosure legislation, which included the total cost of credit and a fees breakdown. Interestingly, most information on the complex SERNAC disclosure could be computed from the information in the simple CAE disclosure: for example, consumers could compute the total cost of credit from the CAE rate and loan term. Yet sophisticated borrowers did not benefit from this additional information until it was explicitly presented to them on a single sheet. This suggests that even sophisticated borrowers either lack the financial education to compute total cost of credit or that they did not have the attentional bandwidth to make these computations. This is consistent with data that participants in an experimental setting are more sensitive to loan rates when they are given the information as monthly installments rather than as an interest rate Zaki 2018.

To our knowledge, our paper is the first to find heterogeneous effects of financial disclosure on different types of consumers. Based on these results, regulators should think carefully about which consumers they wish to serve when suggesting improvements to transparency, as it is difficult to meaningfully serve two different populations with the same intervention.

1.7 Conclusions and Future Work

We exploit a natural experiment where the Chilean government enacted various financial regulations that increased the transparency of various fees and total cost of the loan. We find that regulations that provided borrowers with an APR decreased their delinquency rates by 50% (34 percentage points to 20 percentage points) and default rates by 100%, from 1.7 percentage points to 0.1 percentage points. However, when studied across the broader population, we find that different subgroups differentially benefit from different types of disclosure. More educated borrowers miss payments less often when offered a sheet of disclosure on associated fees related to the origination of a loan, while less educated borrowers benefit from a single number that wraps up all the fees into the interest rate (an APR equivalent), regardless of how the fees break down.

However, despite the distributional differences, our companion paper uses a theoretical model to show that in the long run, the borrower population receives a reduction in interest rates of 180 basis points and experiences a convergence in rates, suggesting that search

[3]Another interpretation is that unsophisticated consumers, who are also likely to be lower-income, were not in a financial position to use information about contingent prepayment and late fees that were included in SERNAC but hidden in CAE. For example, it is possible that lower-income individuals knew about late fees, but were unable to avoid them due to income shocks. On this interpretation, lower income consumers benefit only from information about non-contingent fees that they can plan for when taking out a loan, rather than contingent fees (e.g. late fees) that occur unexpectedly and are difficult for lower-income individuals to avoid.

costs indeed do decrease. This is due to increased competition between lenders, suggesting that the market gets more competitive and ultimately consumers are better off on the order of 15 percentage points. We will continue to explore how these redistributive effects are operationalized – is this due to more borrower sorting or credit rationing on the part of banks?

However, these results raise broader questions about the role of financial literacy and who regulators should be targeting when they seek to aid consumer decision-making. Future work in progress examines the role of just-in-time financial education with Chilean consumers and what delivery methods are most effective in helping consumers make better choices about their loan products.

Chapter 2

Information Frictions in Consumer Credit Markets: A Structural Empirical Approach

Abstract[1]

We evaluate a policy change which made loan characteristics standard and comparable, thus constraining the ability of credit providers to obfuscate prices. Using administrative data from the Chilean banking regulator, we estimate that the introduction of the law caused a drop in equilibrium interest rates for more educated consumers of 94 basis points, from a baseline of 24 percent, which occur due to increased price competition. We develop a dynamic structural model in order to explore the link between reduced informational frictions, price-sensitivity in consumer decisions, and welfare in long-term market equilibrium. We find that, after the policy, information frictions fell around 10 percent, which translated into an interest reduction of 180 basis points. We estimate a welfare improvement for consumers of 15 percent in the long run.

2.1. Introduction

Search costs are generally attributed as a reason that consumers may not switch products as often as they rationally ought to Handel 2013; Illanes 2016; Luco 2013, or to explain price dispersion in SP Index funds "Product Differentiation, Search Costs, and Competition in

[1]Co-authored with Santiago Truffa (Tulane University;struffa@tulane.edu) and Gonzalo Iberti (SBIF; giberti@sbif.cl. We are grateful to John Morgan and Gonzalo Maturana as well as the seminar participants at SBIF for their helpful comments. This research has received financial support from the Alfred P. Sloan Foundation through the NBER Household Finance small grant program.

the Mutual Fund Industry: A Case Study of S&P 500 Index Funds", money market funds Christoffersen and Musto 2002, mutual funds Bergstresser, Chalmers, and Tufano 2009, retail municipal bonds Green, Hollifield, and Schürhoff 2006, online auctions Brown, Hossain, and Morgan 2010, car loans Argyle et al. 2016 and mortgages (see Woodward and Hall 2010,Baye and Morgan 2001 and Baye, Morgan, and Scholten 2006). As many of these products are difficult to understand for consumers, research has suggested that information frictions might be a large component of search costs, but thus far have been unable to measure them.

We exploit a policy change in Chile that explicitly attempted to reduce the information friction component of switching costs for consumers. In 2012, legislation was passed to introduce a standardized loan quote and contract document across banks. We consider this an intervention that explicitly reduced information frictions as the consumer no longer a) had to search through fine print to find relevant fees that may be included in the cost of credit and b) did not have to standardize loan contracts across lenders in order to compare the terms offered by different banks. Using administrative loan-level data from the banking regulator, we find that this introduction of a standardized loan contract reduces average interest rates by 180 basis points due to increased competition across banks. Additionally, we observe a reduction across the standard deviation of average rates, which also suggests that search costs decreased for consumers. Overall, consumers enjoyed an increase in welfare of 15 percent.

Estimating the effects of informational frictions is a challenging task for several reasons. First, to study switching behaviour, it is necessary to observe consumers' loan choices through the entire credit market, rather than data from a few individual lenders. This way, we can most accurately capture changes in switching as we see the universe of lender options that consumers may choose. Additionally, we require detailed loan-level data to be able to measure when a consumer switches between banks (gross flows) in addition to changes in aggregate bank shares (net flows). While the net flows have been used previously to estimate price elasticity across lenders, the gross switching flows within our structural model allow us to explicitly estimate a cognitive cost parameter. Lastly, even if we observe detailed information about banks, loans, and borrowers, it is still hard to empirically disentangle informational frictions from other types of switching costs. Our policy change provides exogenous variation that specifically targets information frictions without changing any other components of switching costs.

Using our policy change and data, we simulate a dynamic structural model to assess welfare implications. Incorporating this structural model is important for a number of reasons, and allows us to make conclusions beyond what would be possible in a reduced-form setting. First, as the model is dynamic, it simulates the gradual adjustment to equilibrium after the shock *ceteris paribus*. Using an event study or some other such framework may not have a post-period long enough to observe the long-run effects. Additionally, the data would be contaminated by other macroeconomic effects and subsequent regulations that were introduced by the Chilean government, further hindering our ability to understand the long-run implications of the pure cognitive cost effects. Lastly, the model allows us to assess the strategic behaviour of banks and consumers separately from the general equilibrium effects

that would only be possible to observe in the data. For example, if fewer consumers were to obtain loans, it would be difficult to disentangle empirically if that were due to lower consumer demand for loans, or strategic behaviour by banks. In our model, we are able to isolate the strategic response by banks and show that it differs by original funding cost.

The rest of the paper is organized as follows. Section 2.2 provides a more detailed discussion of the relevant literature and our contributions. Section 2.3 provides a more detailed discussion of the policy change, and the data is presented in section 2.4. Section 2.5 describes our theoretical model model, **??** the structural estimation, and results of the simulations. Section 2.6 concludes.

2.2. Literature review

Evidence suggests that consumers are not always efficient when choosing among different contracts in the marketplace. The primary evidence often cited for this has been price dispersion: if similar products are priced at widely varying amounts, consumers could have been better off, or attained a more efficient price by merely purchasing the product from a different lender. One prominent explanation for why price dispersion persists in equilibrium is that consumers must expend costly effort to acquire information on prices [2].

There is also an added benefit to sellers if high search costs exist in a product market. Gabaix and Laibson 2006 and Ellison and Wolitzky 2012 show that firms may wish to strategically generate search costs, leading to a reduction in consumer welfare Grubb 2015. More experimental research suggests that when senders have worse information, they are more likely to disguise it in more complex disclosure to receivers when they can benefit from doing so Ginger Zhe Jin 2018. Theoretically, Gabaix and Laibson 2006 has shown that firms may want to strategically generate search costs, but it is not clear whether these costs are necessarily harmful to consumers in equilibrium. Indeed Chioveanu and Zhou 2013 predict that policies that aim to make prices more comparable may end up hurting consumers in equilibrium.

We contribute to this literature by estimating the explicit informational friction component of these search costs. Arguably, this component is most subjected to shrouding and strategic consideration by firms, linking the search cost and shrouding literature. Additionally, contrary to the findings of Chioveanu and Zhou 2013, we find that policies that make prices more comparable actually improve consumer welfare on the magnitude of 15 percent.

Additionally, we contribute to other research findings that have measured switching costs generally in the banking sector, as search costs are only one component of switching costs more generally. We find ?SIMILAR estimates of switching costs as Kim et al. Kim, Kliger, and Vale 2003 using aggregated data for the Norwegian loan market. They provide a structural approach that uses changes in the market position of banks to estimate switching costs. Degryse and Ongena 2005 study borrowers from a Belgian bank and Shy 2002 use a similar

[2]There is abundant theoretical literature studying the pricing implications of search costs. See Farrell and Klemperer 2007 for a thorough review.

methodology to estimate depositor switching costs for four banks in Finland. We contribute to this literature by providing a new structural framework that can exploit comprehensive micro-data rather than the market shares used by previous papers. Our paper offers a methodological contribution, by combining a dynamic trade model that uses gross flows to identify switching costs Artuç, Chaudhuri, and McLaren 2010 with an industrial organization model that use changes in market shares (net flows) to determine price elasticities and mark-ups Berry 1994. Our model also allows us to consider strategic responses from banks in our estimation of a long-run equilibrium and we find that banks with larger funding costs have their market shares drop drastically in response to this increase in transparency.

Contrary to other markets that have been singled out for their high search costs, there has been a willingness to provide legislation to protect consumers in financial transactions. For example, the Truth in Lending Act passed in the United States in 1968 provides consumers with an interest rate that incorporates all the costs of the loan. In 2009, the CARD Act was passed, which outlined to consumers the implications of paying the minimum and other sized payments towards their credit card bill. Agarwal et al. 2014b find that consumers increase the size of their payments, though not at an economically large rate. Increasing the saliency of rates to consumers as done by Ferman 2015, Bertrand and Morse 2011, and Bertrand et al. 2010 show that consumers do not appreciably change their interest rate elasticities if interest rates are shown more prominently. We contribute to this literature in two ways. First, we can observe consumer loan choices across all banks and not just the lenders that were covered under the interventions. Second, we are also able to see how this disclosure affects consumer choice, rather than their repayment behaviour after the loan contract has already been entered into. This allows us to make estimates of long-run consumer welfare across the economy, which to our knowledge are the first such estimates as a result of consumer financial disclosure.

2.3. Transparency shock: Law 20.555

After the 2008 financial crisis, much emphasis was placed on international agencies and national governments to design policies that provided more protection to financial consumers. Reforming the National Consumer Service so that it could intervene in consumer credit markets, represented one of the fundamental campaign promises made by President Sebastian Pinera. In 2009 alone, the National Consumer Service received approximately 328,000 queries and 170,000 claims. Of the latter, 27 percent corresponded to the financial services and insurance sector. The government attributed part of the problem to the fact that

> Financial service providers have not always prioritized their duty to adequately inform consumers so that they can freely decide with whom they should contract. Financial institutions are not providing transparent information to allow consumers to effectively evaluate and compare the costs associated with a credit, like interest rate, commissions and exit costs associated with the termination of the contract.

In response, the Chilean government introduced law 20.555 in March 2012 that aimed to protect consumers in credit markets by regulating and standardizing how relevant information should be presented to consumers. This law built on the introduction of APR (called CAE) that was introduced in 2011 in law 20.448[3]. While law 20.448 regulated all fees associated with the credit product were to be displayed in the CAE, there were still other aspects of the loan contract that financial institutions could obscure in the fine print. Law 20.555 not only mandated that the CAE had to be displayed on both contracts and quotes for credit, it created a summary page (figure 2.1) that lenders had to provide to consumers. This summary page standardized disclosures related to the total cost of credit, fees, insurance, and contingent fees associated with the credit product across lenders. This additional disclosure was created explicitly to reduce informational frictions between borrowers and lenders. As the Ministry of Finance stated in the law,

> We have noted the existence of informational asymmetries in the financial services market for individuals, where the current attributions of the National Consumer Service (SERNAC) have not been sufficient to resolve them. Therefore, we consider it essential to strengthen the consumer protection of financial services, through the allocation of greater powers and competencies to SERNAC, improving the delivery of information and carrying out studies that reduce information asymmetries.

In addition to the standardization of loan contracts, the law strengthened consumer financial protection through the allocation of more competencies to the National Consumer Service. This gave the National Consumer Service more resources and powers that would enable the agency to more effectively monitor financial institutions and enforce their compliance with the new and existing laws that protected financial consumers.

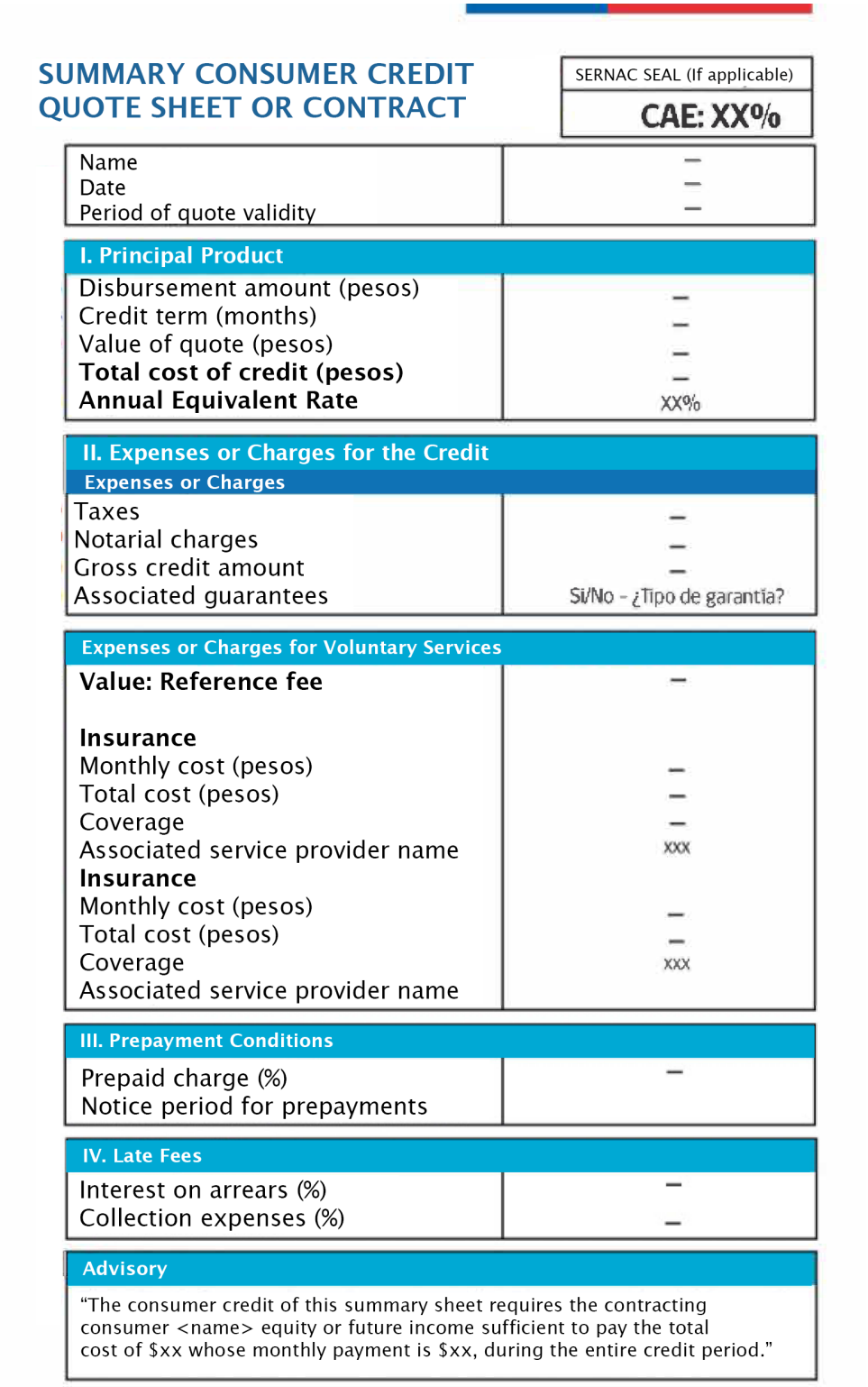
2.4. Data

We use administrative data reported to the Superintendica Banquero y Instituciones Financieros (SBIF), which is the Chilean banking regulator. All banks must periodically (in our case, bi-weekly) disclose to SBIF detailed information about new credit operations and the current state of their credit portfolio for regulatory purposes. This administrative dataset allows us to observe the entire banking system, for which we have detailed information for each loan at its origination date and its performance in time along with information about borrower characteristics.

Our analysis focus on consumer loans because they are simple and easy to compare vis-à-vis other financial products. These loans are non-collateralized loans, and many financial institutions offer them. Consumers may use these loans for durable purchases, vacations, and many other options. These consumer loans co-exist with a robust credit card industry,

[3]The implications of this regulation are explained in a companion paper.

Figure 2.1: English Translation of SERNAC Regulatory Disclosure



SUMMARY CONSUMER CREDIT QUOTE SHEET OR CONTRACT

SERNAC SEAL (If applicable)

CAE: XX%

Name	–
Date	–
Period of quote validity	–

I. Principal Product

Disbursement amount (pesos)	–
Credit term (months)	–
Value of quote (pesos)	–
Total cost of credit (pesos)	–
Annual Equivalent Rate	XX%

II. Expenses or Charges for the Credit

Expenses or Charges

Taxes	–
Notarial charges	–
Gross credit amount	–
Associated guarantees	Si/No - ¿Tipo de garantía?

Expenses or Charges for Voluntary Services

Value: Reference fee	–
Insurance	
Monthly cost (pesos)	–
Total cost (pesos)	–
Coverage	–
Associated service provider name	xxx
Insurance	
Monthly cost (pesos)	–
Total cost (pesos)	–
Coverage	xxx
Associated service provider name	

III. Prepayment Conditions

Prepaid charge (%)	–
Notice period for prepayments	

IV. Late Fees

Interest on arrears (%)	–
Collection expenses (%)	–

Advisory

"The consumer credit of this summary sheet requires the contracting consumer <name> equity or future income sufficient to pay the total cost of $xx whose monthly payment is $xx, during the entire credit period."

though not a market for borrowing against housing collateral. As these loans are common, simple, relatively homogenous, easy to compare, and easy to move between banks they should be the most sensitive to changes in the informational environment.

Our sample runs from 2009 until 2015 and covers 95 percent of non-collateralized loans under 1,500 UF ($60,000 USD). [4]. Since this data is reported to banks by consumers in order to obtain a loan, each institution can ask for supporting documents, such as taxes or proof of income in order to verify the information that is ultimately reported to the SBIF. Finally, we merge our loan files by RUT (the Chilean equivalent to a social security number) to data from the National Civil Registry that allow us to include borrower demographics such as age, gender, nationality and civil status to use as controls in our analysis.

Table 2.1 reports summary statistics for the 7.6 million loans in our six year sample. The average interest rate for the sample is 24 percent, which is consistent with rates for similar products in Latin America. The average loan size is approximately $4,000 USD, or 1/6th of the average annual income. The average maturity for these loans is 27 months, which suggests that the majority of the loans are relatively small and for short durations. Roughly one quarter of these loans will have one payment missed, while less than one percent of the loans will have payments missed for over three months.

We augment our data with variables from the Central Bank of Chile, to construct instruments for the interest rate that we will use in our estimation as costs shifters. We use the time series for the interbank rate in UF and pesos, which allows us to control for the daily level of interest rates and calculate expected inflation. We use annual bank balance sheet data to compute the ratio of interest paid over financial liabilities, to equity to to measure banks' relative cost of funding.

Figure 2.2 shows the histogram of the residual of interest rates on loan and consumer characteristics. Consistent with prior literature on search and switching costs in financial products, we find substantial price dispersion even when controlling for a variety of observable characteristics. To examine whether switching costs are reduced in the raw data, we plot a box plot with the total gross flows by region 100 days before and after the policy change in figure 2.3. We observe that more consumers decided to switch banks before the policy

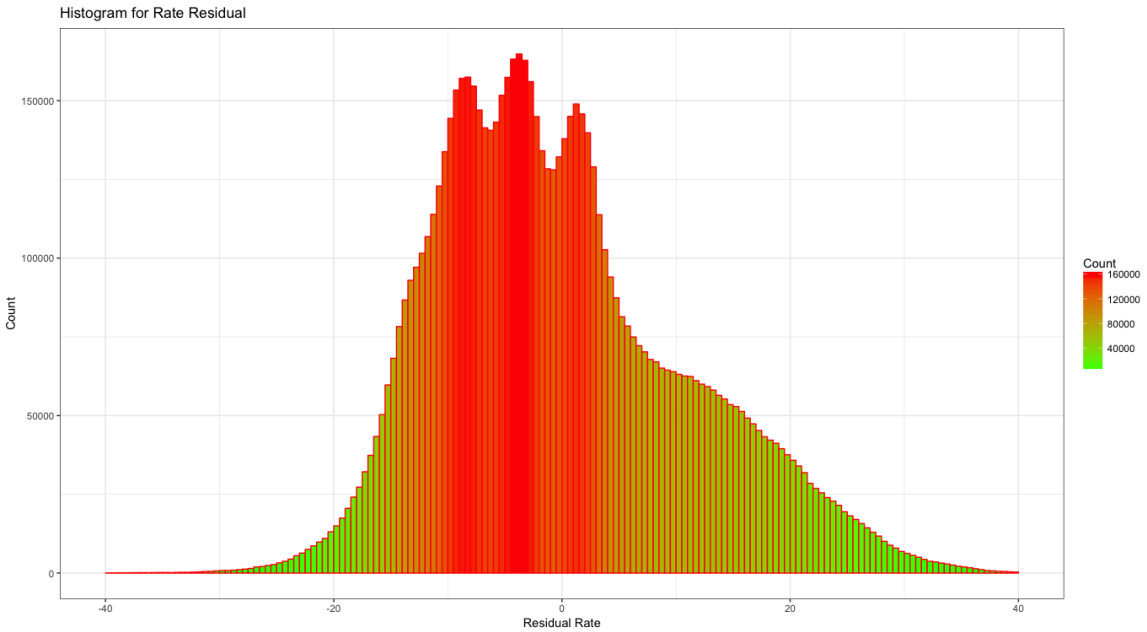
[4]The other 5 percent of loans were lost as they were not able to be merged across the various data files that housed borrower information. The data comes from 4 different files. First, we have data from file D32, which reports all loans that were originated on a given day. From D32 we get the day of the operation, the lender, the currency, loan size, maturity, type of rate and interest rate. D32 also identifies the borrower and a code identifying each loan. Secondly, we have data from file C12, which is a file where banks report monthly the state of their credit portfolio at the loan level. From C12 we can know whether a loan is late on a payment or has been delinquent. We also can observe how much the bank is provisioning for performing and non-performing operations giving us a measurement loan risk. Thirdly we get data from file D03, which contains borrower characteristics. File D03 has data on *comuna* where the borrower resides and self-reported annual income. As loan codes are not always consistent across files, we generate a conditional merge on loan and borrower characteristics. For loans with partial similarities in loan code, we check for the following features to coincide: borrower ID, date of origination, interest rate, maturity and loan size. We incorporate to our sample all loans that had coinciding loan codes, or we were able to match on their characteristics across files.

Table 2.1: Summary Statistics Unique Loans

Statistic	N	Mean	St. Dev.	Min	Max
maturity	7,655,263	27.129	19.738	1	367
annual_rate	7,655,263	24.317	13.698	0.000	75.120
loan_size	7,655,263	2,704,592	3,869,648	1	170,837,440
annual_income	7,655,263	12,633,395	4,380,763	0	4,042,936,038
ever_default	7,655,263	0.260	0.439	0	1
ever_delinqued	7,655,263	0.007	0.082	0	1
age	7,655,263	44.243	13.658	18	116.071
years_married	7,655,263	12.527	14.913	0.1	70.3
death	7,655,263	0.002	0.049	0	1
civil_status	7,655,263	1.519	0.752	1	7
gender	7,655,263	1.417	0.496	0	2
nationality	7,655,263	1.026	0.233	0	3

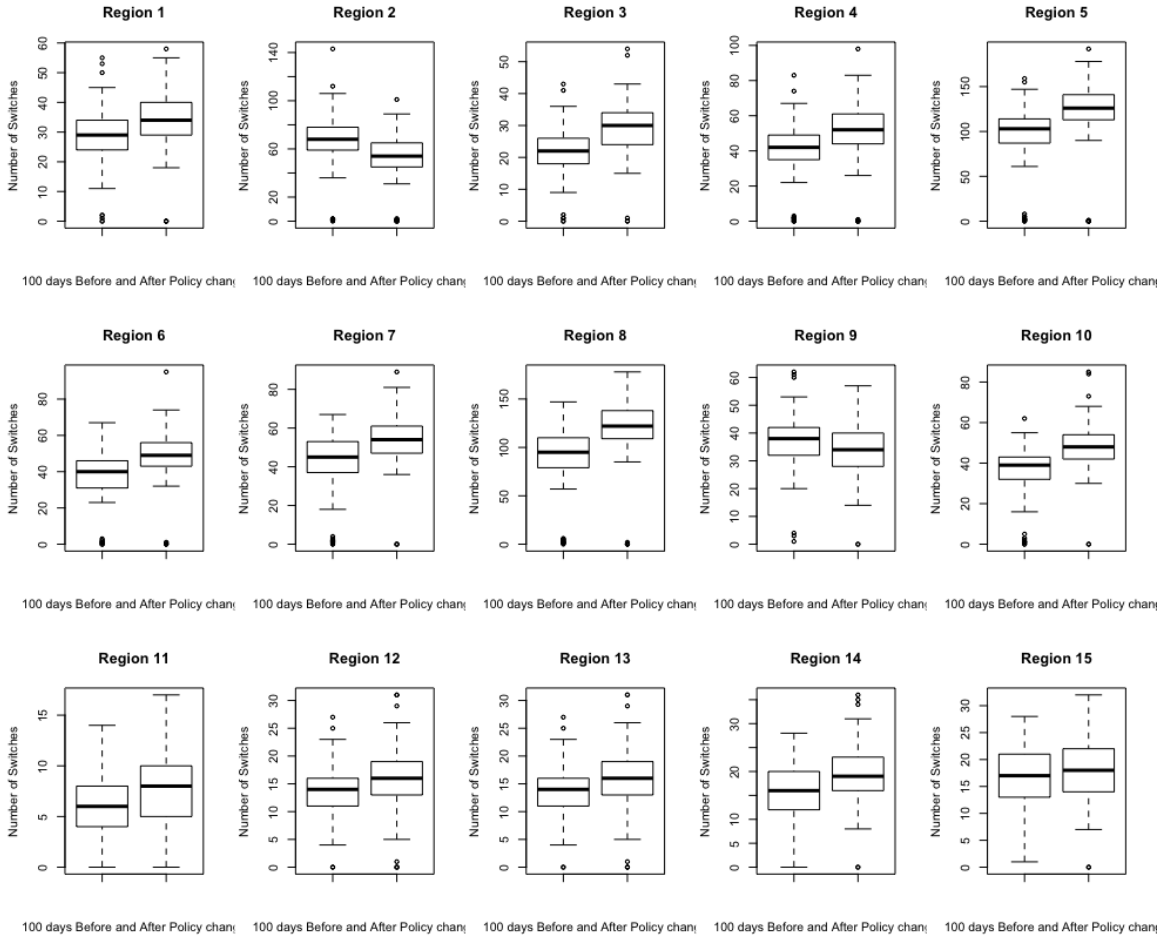
change. However, from figure 2.4 we observe that banks that have lower costs of financing gained market power after the policy change, suggesting that consumers were more likely to switch to banks that had a lower cost of funding.

Figure 2.2: Price Dispersion



Un-explained rate dispersion

Figure 2.3: Total Switches by Region Before and After Policy Change



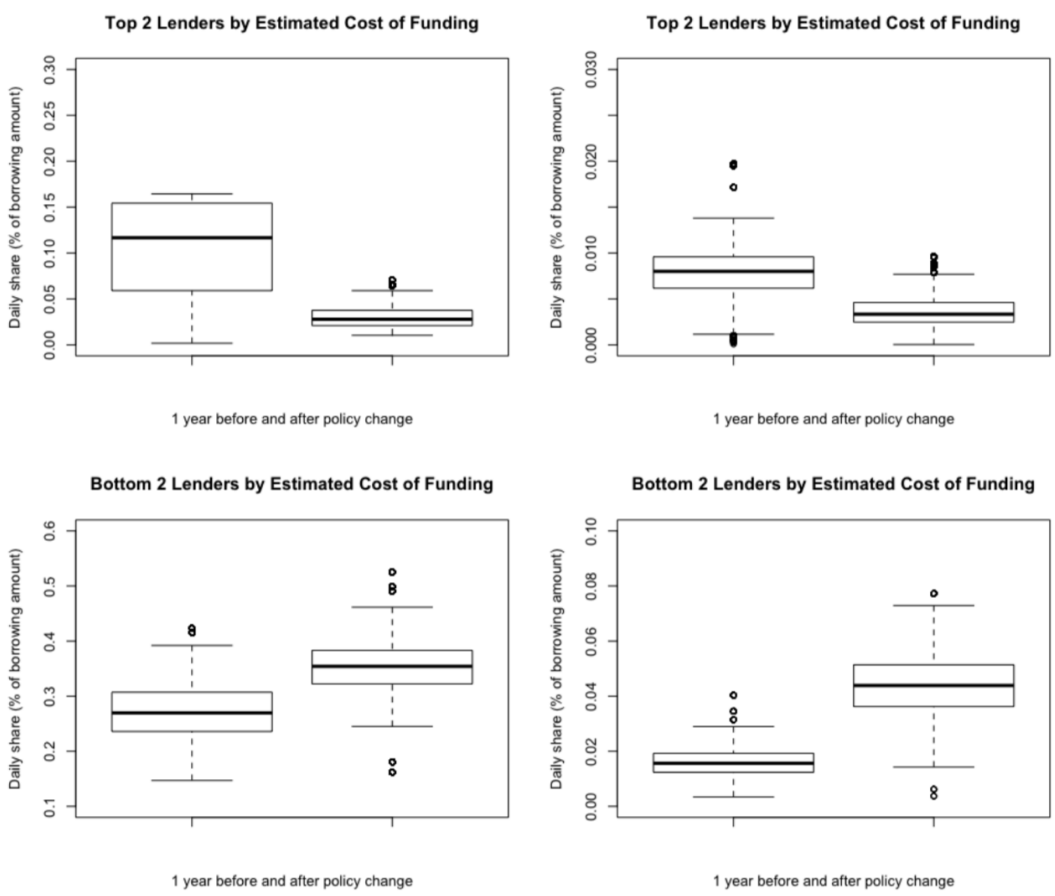
Box-plot captures predicted elasticities by Lender

2.5. Model and Estimation

. Model Framework

To explore how this disclosure affected the long-term equilibrium of the market, we developed a dynamic structural model that takes into consideration the strategic response of banks and the transitional dynamics these reactions generate. In the model, consumers behave accordingly to a dynamic rational expectations model. Each period consumers require one unit of money to borrow. They search across different banks for the best price, however there are frictions to this search which explain why not all consumers get the lowest price available in the market. Banks are profit maximisers. Each period they charge an interest rate which is a markup over their cost of funding.

Figure 2.4: Daily shares for top 2 and bottom 2 lenders by cost of funding, Before and After Policy Change



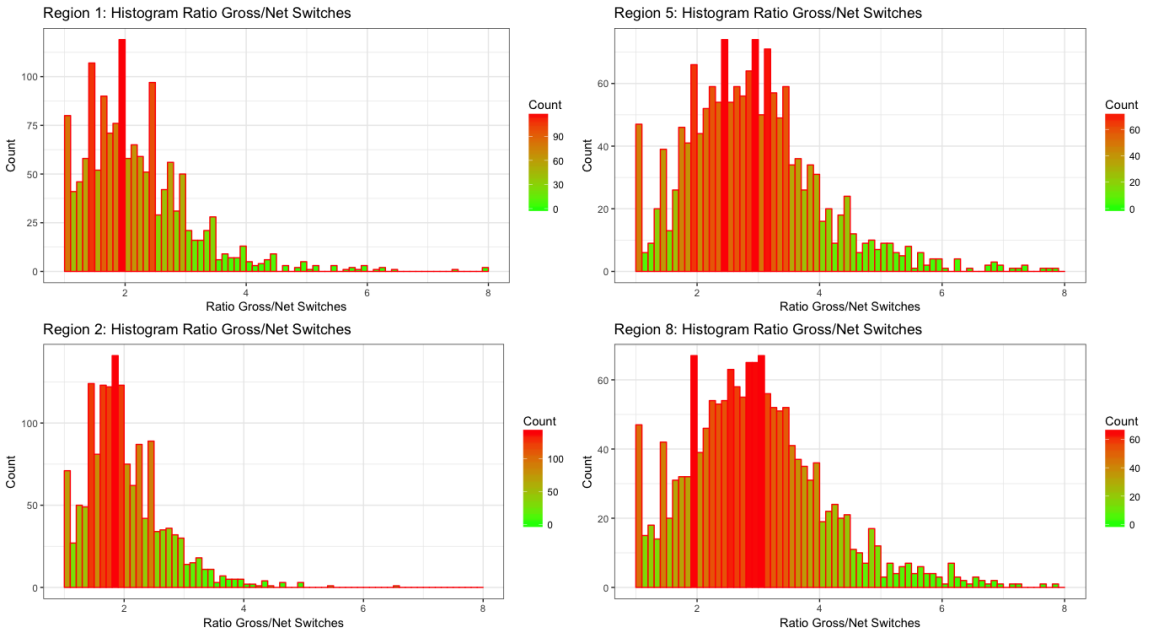
Box-plot captures predicted elasticities by Lender

We divide our estimation procedure into two parts. First, we estimate price elasticities for banks using data on net switching flows between banks. Secondly, to recover the sensitivity of consumers to relative prices and how this sensitivity changes as the informational environment becomes more transparent, we use gross switching flows of clients between institutions. While net flows have traditionally been used to derive changes in market power, they are not ideal to identify changes in consumer behaviour.[5] Thus, we use gross switching flows between banks to capture changes in consumer switching behaviour over time. Indeed, figure 2.5 shows a histogram for the ratio of gross to net flows for different regions in Chile. Gross flows are on average three times higher than net flows. Using only net switches then

[5]This is because any parameter in the utility function used to distinguish different preferences across banks would not be able to identify anything other than a fixed effect taste parameter for that bank and would not identify the impact of a change in disclosure on such fixed effects.

underestimates the overall switching behaviour by consumers.

Figure 2.5: Gross vs Net Flows



This figure plots the ratio between daily total switches to daily net switches for all banks in a given region.

We estimate that switching costs drop around 10 percent after the policy intervention. We then evaluate what would happen to the credit market when we shock the switching friction parameter by this amount. In our simulations, we find that banks with a lower cost of funding see their market shares dramatically decrease, as consumer switch to banks that offer lower interest rates. Banks strategically react to consumer switching in two ways. First, banks that are losing market power reduce their interest rates to be more competitive, whereas banks that are gaining market power, tend to increase interest rates. In the long run, a ten percent drop in switching frictions implies a long-term reduction of around 180 basis points in the average interest rate. This rate reduction means an average consumer welfare improvement of the order of 15 percent.

. Banks

In each regional market, there are J banks. Banks are profit maximizers facing a downward-sloping demand curve. Each bank has a marginal cost of funding, which captures differences in financial expenditures and bank efficiency across banks. Banks charge an equilibrium interest rate which is a markup over their marginal cost. This rate can differ by region depending on the bank's market power. From the profit maximizing behaviour of banks for each period, we derive the following markup rule:

$$r_j^I = MC_j^I/(1-(1/\varepsilon_j^I))$$

where, r_j^I is the average interest rate that bank j charges in region I and ε_j^I is the elasticity of demand, that bank j in region I. MC_j^I is the marginal cost of funding for bank j in region I.

We can infer the long-term demand elasticity ε_j^I for each lender (for each region) from market share data. To do so, we use a random utility model such as in Berry 1994. In every region consumers need to choose between J banks. The long-term utility that a consumer i gets from banking in j is given by:

$$u_{ij} = \beta X_j - \rho r_j + \epsilon_j + \varepsilon_{ij}$$

where X_j is a vector of bank observable characteristics, ϵ_j captures a bank level un-observable characteristics, and ε_{ij} is consumer level idiosyncratic error term which follows an extreme value distribution.

Let $\delta_j = \beta X_j - \rho r_j + \epsilon_j$ be the mean utility for bank j. Then $\delta = (\delta_1, .., \delta_J)$ is a vector of taste for banks which captures the fidelity to a given bank.

Let s_j be the aggregate market share for bank j, then $s_j = exp(\delta_j)/\sum_{j'=1}^{J} exp(\delta_{j'})$. Given shares, we can recover average taste for a bank, $\hat{\delta}_j = log(\hat{s}_j) - log(\hat{s}_0)$, from observed market shares. This yields the following estimating regression:

$$\hat{\delta}_j = log(\hat{s}_j) - log(\hat{s}_0) = \beta X_j - \rho r_j + \epsilon_j$$

The above expression suffers from endogeneity as equilibrium rates also depend on consumer's preferences and not just on the markup derived from each bank. In order to estimate the exogenous variation in interest rates, we use instruments that affect equilibrium interest rates for reasons that are orthogonal to consumers? preferences. We use daily interbank interest rate, which measures macroeconomic effects that influence the cost of lending for all banks. As inflation is also an exogenous shifter of rates, we use current and expected inflation, which we infer using the peso and UF(inflation indexed)[6] interbank rates. Finally, we use the monthly ration between financial interest expenses and equity that we use as an instrument for cost of funding by institution. From our first stage regression, we recover $\hat{\rho}$.

Given our specification it can be shown that demand elasticity is given by:

$$\hat{\varepsilon}_j^I = -\hat{\rho} r_j (1 - s_j)$$

We can recover the marginal cost of funding for each bank from our markup formula:

$$MC_j^I = r_j^I (1 - 1/\epsilon_j^I)$$

Where, r_j^I is an average interest rate for lender that we observe in our data, and ϵ_j^I is the elasticity we recovered using market shares. We will approximate the marginal cost for each lender, by the average of observed marginal costs.

[6]Loans in Chile are given in an inflation-indexed currency called UF whose exchange rate changes on a biweekly basis and is set by the Chilean government.

Additionally, using our approximation of banks' cost of funding, we predict how banks are expected to strategically change their prices when consumers' switching behaviour affect their (endogenous) market power in different markets.

$$r_j^I = \frac{1 + \hat{\rho}(1 - s_j^I)\bar{MC}_j}{\hat{\rho}(1 - s_j^I)} = \bar{MC}_j + \frac{1}{\hat{\rho}(1 - s_j^I)}$$

A To estimate the above model, we use data on net flows (market participation data) for banks for our entire sample. We aggregate data to the bank/region level for each month. Our first and second stage estimation of our bank parameters is shown in table 2.2.

We estimate a sensitivity to interest rates of 0.04. This parameter value translates into a mean price elasticity of 0.77 (inelastic).

Of course, this parameter will imply different market powers for each lender and for each market. Figure 2.6 shows predicted elasticities for different lenders in different markets. We observe that the same lender has higher elasticities in more competitive regions, and that within the same region, lenders have a wide spread of elasticities.

The advantage of modeling banks this way, is not only that we can easily recover elasticities using market share data, but also the fact that close form solutions depend on the fundamental endogenous variables of the model (rates and shares), makes the computation of the dynamic general equilibrium model feasible.

. Consumers

To model consumer behaviour we borrow a trade model from Artuç, Chaudhuri, and McLaren 2010. Consumers have a inelastic demand for 1 unit of loan, every period. Each consumer starts a period t in some bank i where he pays an interest rate r_t^i for his loan. Borrowers search for credit opportunities. They receive a vector of iid utility shocks $\varepsilon^t = \{\varepsilon_j^t\}$, from each bank $j \epsilon \{1..J\}$. After observing these shocks, each consumer decides to either get a new loan on another bank, or stay on their current bank. For several reasons, borrowers will not always choose the best alternative. To allow for this possibility, we posit the existence of a wedge C^{ij} , which we call informational friction, that can be the interpreted as the costs of comparing offers from bank j given that the costumer is currently a client in bank i. We assume $C^{ii} = 0$.

If a consumer decides to switch, then she starts next period $t + 1$ in bank j. There is going to be a common discount rate $\beta > 0$, and a rate sensitivity/preference parameter ρ (from before). Let B_t be the allocation of borrowers in period t.

The utility of a borrower who in period t is a client in bank i is given by:

$$U^i(\varepsilon_t) = -\rho r_t^i + max_{j \epsilon 1..J}\{\varepsilon_t^j - C^{ij} + \beta V(B_{t+1})]\}.$$

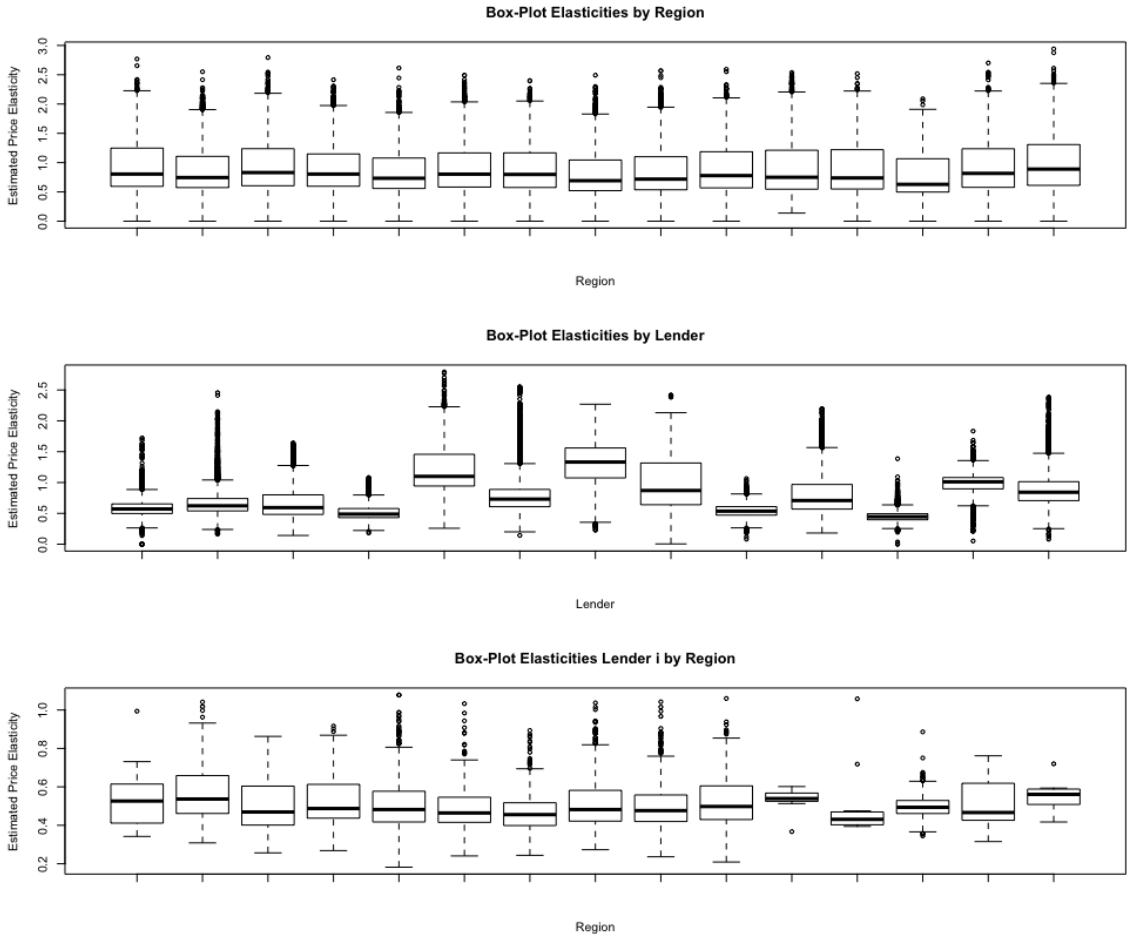
Where:

$$V^j(B_{t+1}) = E_\varepsilon[U^i(B_{t+1}, \varepsilon_t)],$$

Table 2.2: Logarithmic regressions, exploiting shares

	Dependent variable:	
	log(share)	
	IV Model	IV Model+LR FE
	(1)	(2)
maturity	-0.018^{***}	-0.019^{***}
	(0.0004)	(0.0004)
amount	0.00000^{***}	0.00000^{***}
	(0.000)	(0.000)
rate_type	0.408^{***}	0.372^{***}
	(0.009)	(0.009)
age	-0.00003^{***}	-0.00003^{***}
	(0.00000)	(0.00000)
e_civil_lrd	0.054^{***}	0.045^{***}
	(0.007)	(0.006)
gender	0.089^{***}	0.132^{***}
	(0.012)	(0.011)
nationality	-0.237^{***}	-0.153^{***}
	(0.025)	(0.024)
risk		-0.00000
		(0.00000)
rate	-0.035^{***}	-0.040^{***}
	(0.001)	(0.001)
Constant	-44.440^{***}	-40.532^{***}
	(0.967)	(0.924)
Observations	194,140	194,140
R^2	0.090	0.169
Adjusted R^2	0.090	0.169
Residual Std. Error	1.369 (df = 194131)	1.308 (df = 194115)
Note:		*p<0.1; **p<0.05; ***p<0.01

Figure 2.6: Predicted Elasticities by Region, Lender and LR



Box-plot captures predicted elasticities by Lender

is the average utility across idiosyncratic shocks. Taking expectation over idiosyncratic shocks:

$$V_i^i = -\rho r_t^i + E_\varepsilon \left[max_{j\epsilon 1..J} \{ \varepsilon_t^j - C^{ij} + \beta [V^j(B_{t+1})] \right]$$

$$= -\rho r_t^i + \beta V_{t+1}^i + E_\varepsilon \left[max_{j\epsilon 1..J} \{ \varepsilon_t^j - C^{ij} + \beta \{ [V^j(B_{t+1}) - V_{t+1}^i) \} \} \right] \equiv -\rho r_t^i + \beta V_{t+1}^i + \Gamma_t^i$$

On average, the utility of currently being in bank i can be decomposed into the utility of being forever in bank i, given by $-\rho r_t^i + \beta V_{t+1}^i$, plus the option value of moving.[7]

[7]This characterization is consistent with our utility for banks in the long run. In the steady state of this model, the preference for a bank depends on a bank fixed effect (a composite of the preference for that bank's characteristics) plus an error term.

We assume opportunity shocks to be *iid* across time and borrowers, and distributed extreme value type 1 with mean zero and variance parameter ν, then

$$f(\varepsilon) = \frac{e^{-\varepsilon/\nu-\gamma}}{\nu} exp\{-e^{-\varepsilon/\nu-\gamma}\}$$

and

$$F(\varepsilon) = exp\{-e^{-\varepsilon/\nu-\gamma}\}$$

Under this parametric assumption, the fraction of moving borrowers from bank i to bank j is going to be given by:

$$m_t^{ij} = \frac{exp\{(-C^{ij} + \beta V_{t+1}^j)/\nu\}}{\sum_k exp\{(-C^{ik} + \beta V_{t+1}^k)/\nu\}}$$

normalizing by the fraction of borrowers who stayed in the same bank:

$$\frac{m_t^{ij}}{m_t^{ii}} = \frac{exp\{(-C^{ij} + \beta V_{t+1}^j)/\nu\}}{exp\{(\beta V_{t+1}^i)/\nu\}} = exp\{(-C^{ij} + \beta(V_{t+1}^j - V_{t+1}^i))/\nu\}$$

and thus:

$$\nu(log(m_t^{ij}) - log(m_t^{ii}) = -C^{ij} + \beta(V_{t+1}^j - V_{t+1}^i))$$

Now we can compute the option value of changing banks, under the same assumption of *iid* shocks:

$$\Gamma_t^i = E_\varepsilon \left[max_{j\epsilon 1..N}\{\varepsilon_t^j - C^{ij} + \beta[V^j(B_{t+1})]\right]$$

$$exp(\Gamma_t^i/\nu) = \sum_k exp\{(-C^{ik} + \beta(V_{t+1}^k - V_{t+1}^i))/\nu\}$$

using again the stayers for normalization

$$m_t^{ii} = \frac{exp\{(\beta V_{t+1}^i)/\nu\}}{\sum_k exp\{(-C^{ik} + \beta V_{t+1}^k)/\nu\}} \Rightarrow m_t^{ii} = \frac{1}{exp(\Gamma_t^i/\nu)}$$

So the the option value of staying in a bank is going to be given by

$$\Gamma_t^i = -\nu log(m_t^{ii})$$

Therefore we can now express everything in terms of observables. Taking differences across banks we get:

$$V_t^j - V_t^i - \rho r_t^j + \rho r_t^i + \beta(V_{t+1}^j - V_{t+1}^i) + \Gamma_t^j - \Gamma_t^i = 0$$

Which can be fully express in observables

Table 2.3: Logarithmic Regressions, Exploiting Shares

	Dependent variable:		
	reg_region		
	beta = 0.9	beta = 0.95	beta = 0.97
	(1)	(2)	(3)
drate_res_region	0.28747*	0.25406*	0.24531*
	(0.0132)	(0.014)	(0.014)
Constant	−0.34907***	−0.21464***	−0.17906***
	(1.63e-08)	(9.77e-05)	(0.000803)
Observations	16,839	16,839	16,839
R^2	−12.436	−12.436	−12.436
Adjusted R^2	−12.437	−12.437	−12.437
Residual Std. Error (df = 16837)	2.878	2.878	2.878
Note:			*p<0.1; **p<0.05; ***p<0.01

$$\frac{\nu}{\beta}(log(m_t^{ij}) - log(m_t^{ii})) + \frac{C^{ij}}{\beta} - E_t\rho\{r_{t+1}^j - r_{t+1}^i\} - \nu(log(m_{t+1}^{ij}) - log(m_{t+1}^{ii})) - C^{ij} = 0$$

And this yields the following estimating equation:

$$log(m_t^{ij}) - log(m_t^{ii}) - \beta(log(m_{t+1}^{ij}) - log(m_{t+1}^{ii})) = \frac{-(1-\beta)}{\nu}C^{ij} + (\beta/\nu)(\rho r_{t+1}^j - \rho r_{t+1}^i) + \upsilon_{t+1}$$

As before, we instrument for rates using interbank and inflationary cost shifters to prevent endogeneity in our estimates of bank rates. To estimate the above model, we use gross flows (switches) of clients between institutions aggregated at the bank/region level for each month. Table 2.3 reports the first- and second-stage results for the above model. (The estimates imply the following parameter values. For beta = 0.9 , a volatility of 3.13 and informational friction parameter of 10.93. For beta = 0.95 , a volatility of 3.7 and informational friction parameter of 16.05. For beta = 0.97 , a volatility of 3.95 and informational friction parameter of 23.6.)

We can map the point estimates for the linear regression to an implicit C (switching cost) and ν (volatility). These estimates imply the following parameter values. For $\beta = 0.9$, a volatility of 3.13 and a switching cost parameter of 10.93. For $\beta = 0.95$, a volatility of 3.7

Table 2.4: Obfuscation Parameter Estimation, Using Windows Before and After Policy

	Dependent variable:		
		reg_region	
	12 Month Period	Before	After
	(1)	(2)	(3)
lenderFE	0.005	0.013**	0.001
	(0.004)	(0.006)	(0.004)
regionFE	0.002	−0.004	0.004
	(0.003)	(0.004)	(0.006)
drate_res	0.022	0.036**	0.019
	(0.016)	(0.018)	(0.030)
Constant	−0.132***	−0.184***	−0.095***
	(0.033)	(0.050)	(0.036)
Observations	9,014	4,282	4,732
R^2	−0.085	−0.190	−0.073
Adjusted R^2	−0.086	−0.191	−0.074
Residual Std. Error	0.753 (df = 9010)	0.806 (df = 4278)	0.734 (df = 4728)
Note:			*p<0.1; **p<0.05; ***p<0.01

and switching cost parameter of 16.05. For $\beta = 0.97$, a volatility of 3.95 and switching cost parameter of 23.6. This numerical estimate of switching costs includes a variety of factors such as direct costs of switching, inertia, and informational frictions. To isolate the influence of increased disclosure, we estimate C both before and after the policy came into effect.

. Information Frictions Parameter

In order to identify the change in switching sots solely attributable to transparency. For this reason, we consider switches within a seven month window before and after the policy change to estimate C. To calculate C from the regression tables, we use a β of 0.95. Table 2.4 reports the results for this regression (using 7 month window, these estimates imply a fall in Informational friction between 8 and 15 percent; afterwards, we evaluate 10).

Our point estimates suggest that there was a drop in switching cost of around 10 percent. Using the confidence interval for our point estimate on the constant, we see a drop between

8 and 15 percent in C. In our simulation we will use a drop in 10 percent as our main specification. However, as this is measures an average treatment effect, our computations mask the significant heterogeneity across different types of consumers. For example, consumers with more education were more responsive to this disclosure and received lower rates than consumers with less education. Further exploring different sources of heterogeneity across consumers and its distributive effects is part of our future research agenda.

. Steady State Results

In this section we incorporate our estimated parameters into our economy-wide model to compute consumer welfare and examine competitive responses by banks.

Recall we had with the following utility function for a consumer:

$$U^i(L_t, \varepsilon_t) = \rho r_t^i + max_{j\epsilon 1..J} E_\varepsilon\{\varepsilon_t^j - C^{ij} + \beta V^j(B_{t+1})\} = \rho r_t^i + \beta V^i(B_{t+1}) + max_{j\epsilon 1..J} E_\varepsilon\{\varepsilon_t^j + \bar{\varepsilon}_t^{ij}\}$$

where $\bar{\varepsilon}_t^{ij} \equiv \beta[V^j(B_{t+1}) - V^i(B_{t+1})] - C^{ij}$

Let $\bar{\varepsilon_t}^i = (\bar{\varepsilon}_t^{i1}, .., \bar{\varepsilon}_t^{iJ})$, and taking the expectation with respect to ε we get:

$$V^i(B_t) = \rho r_t^i + \beta[V^i(B_{t+1})] + \Phi(\bar{\varepsilon_t}^i)$$

where

$$\Phi(\bar{\varepsilon_t}^i) = \sum_{j=1}^{J} \int_{-\infty}^{\infty} (\varepsilon^j + \bar{\varepsilon_t}^{ij}) f(\varepsilon^j) \prod_{k \neq j} F(\varepsilon^j + \bar{\varepsilon_t^{ij}} - \bar{\varepsilon_t^{ik}}) d\varepsilon^j = E_\varepsilon[max_{j\epsilon 1..J}\{\varepsilon_t^j + \bar{\varepsilon}_t^{ij}\}]$$

To compute the steady state of this economy, let $V^i(B_t, s_t)$ represent the expected discounted utility of a consumer in bank i at time t

Worker optimization implies the following Bellman Equation:

$$U^i(L_t, \varepsilon_t) = \rho r_t^i + max_{j\epsilon 1..J} E_\varepsilon\{\varepsilon_t^j - C^{ij} + \beta V^j(B_{t+1})\} = \rho r_t^i + \beta V^i(B_{t+1}) + max_{j\epsilon 1..J} E_\varepsilon\{\varepsilon_t^j + \bar{\varepsilon}_t^{ij}\}$$

where $\bar{\varepsilon}_t^{ij} \equiv \beta[V^j(B_{t+1}) - V^i(B_{t+1})] - C^{ij}$

At any date t there is a threshold value $\bar{\varepsilon_t}^{ij}$ such that a consumer will stay in bank i if $\varepsilon_t^i > \bar{\varepsilon_t}^{ij}$ or would switch to bank j otherwise.

Let $\bar{\varepsilon_t}^i = (\bar{\varepsilon}_t^{i1}, .., \bar{\varepsilon}_t^{iJ})$, and taking the expectation with respect to ε we get:

$$V^i(B_t) = \rho r_t^i + \beta[V^i(B_{t+1})] + \Phi(\bar{\varepsilon_t}^i)$$

where

$$\Phi(\bar{\varepsilon_t}^i) = \sum_{j=1}^{J} \int_{-\infty}^{\infty} (\varepsilon^j + \bar{\varepsilon_t}^{ij}) f(\varepsilon^j) \prod_{k \neq j} F(\varepsilon^j + \bar{\varepsilon_t}^{ij} - \bar{}^{ik}_t) d\varepsilon^j = E_\varepsilon[max_{j \epsilon 1..J}\{\varepsilon_t^j + \bar{\varepsilon}_t^{ij}\}]$$

$\Phi(\bar{\varepsilon_t}^i)$ is the option value of a borrower in bank i. What make this computation feasible, is that given the properties of the extreme value distribution is can be shown that[8]:

$$\Phi(\bar{\varepsilon_t}^i) = \nu log[\sum_{k=1}^{J} exp(\bar{\varepsilon_t}^{ik}/\nu)]$$

Having a close form expression for this expectation allows us to numerically compute the equilibrium of this economy.

The properties of the extreme value distribution, also imply a very simple expression for the law of motion of consumers between banks, which is given by:

$$B_{t+1}^i = \sum_{j=1}^{J} m_t^{ij} B_t^j$$

where

$$m_t^{ij} = \frac{exp(\bar{\varepsilon}_t^{ij}/\nu)}{\sum_{k=1}^{J} exp(\bar{\varepsilon}_t^{ik}/\nu)}$$

and m_t^{ij} is the fraction of workers in bank i that decide to move to j in period t.

The general strategy for computing the steady state is to recover the steady state values of $B^* = (B^{1*}, .., B^{J*})$ from the steady state values of $\bar{\varepsilon}^* = (\bar{\varepsilon}^{1*}, ..., \bar{\varepsilon}^{J*})$, which will then determine the steady state of interest rates $r^* = (r^{1*}, ..., r^{J*})$

More formally, from $V^i(B_t) = \rho r_t^i + \beta[V^i(B_{t+1})] + \Phi(\bar{\varepsilon_t}^i)$ write steady state values of V^* as a function of the steady state values of $\bar{\varepsilon}^*$

Secondly, substitute V^* in $\bar{\varepsilon}_t^{ij} \equiv \beta[V^j(B_{t+1}) - V^i(B_{t+1})] - C^{ij}$

Finally, to close the system we need the endogenous interest rate. Because we have a closed-form solution for interest rates, they depend only on the share of clients that each bank has on a given region.

$$r_{t+1}^i = \bar{MC}_i + \frac{1}{\hat{\rho}(1 - s_{t+1}^i)} = \bar{MC}_i + \frac{1}{\hat{\rho}(1 - \frac{B_{t+1}^i}{\sum_j B_{t+1}^j})}$$

This provides a system of non-linear equations that we solve numerically.

[8]For a derivation see Artuc et al 2015.

. Dynamic Equilibrium and Welfare Calculations

We start from the steady state equilibrium.
First we compute the value of V_0^* for all i

$$V_0^{*i} = \frac{1}{1-\beta}[\hat{\rho} r_0^{*i} + \nu log(\sum_{k=1}^{J} exp(\bar{\varepsilon}_0^{*ik}/\nu)]$$

Recursively we have the following expressions:

$$V_{t+1}^i = \frac{1}{\beta}[V_t^i - \hat{\rho} r_t^i - \nu log(\sum_{k=1}^{J} exp(\bar{\varepsilon}_t^{ik}/\nu)]$$

$$\bar{\varepsilon}_{t+1}^{ij} = \beta[V_{t+1}^j - V_{t+1}^i] - C^{ij}$$

Given that we already have a law of motion for consumers, and a closed-form solution for interest rates, then we can compute for each period, the equilibrium of this economy.

Finally, it is possible to approximate the full time welfare effects without computing value functions.To see this, recall the borrowers' Bellman equation, and consider what happens if we implement small changes to switching costs (for example via a transparency policy shock), which can effect the allocation of consumers across banks, and thus, equilibrium interest rates.

Employing the Envelope Theorem repeatedly, the effect of a change in switching costs for a worker in bank i can be written as:

$$\frac{\partial V^i}{\partial C} = \sum_{t=0}^{\infty}\sum_{j=1}^{J} \beta^t m_t^{ij} \rho \frac{\partial r^i}{\partial C} \sim \sum_{t=0}^{\infty}\sum_{j=1}^{J} \beta^t m_t^{ij} \rho \frac{\triangle r_t^i}{\triangle C}$$

Since we can calculate the trajectory of interest rates for each bank after a a small perturbation of C, and we can calculate the law of motion of consumers, we obtain an estimate of the welfare effects that this change induces.

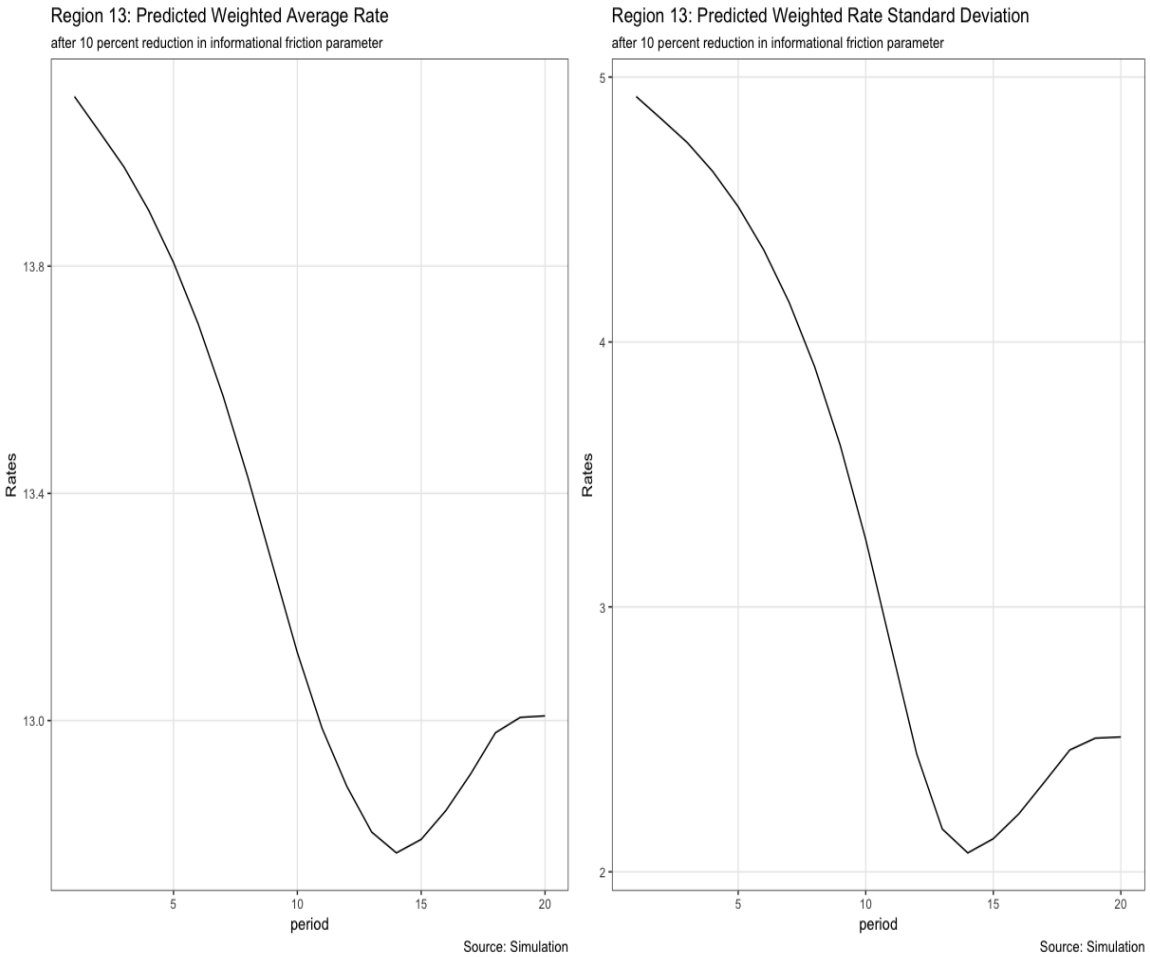
. Simulations and Results from the Model

Now that we have derived our economy-wide model, we shock the switching friction parameter by a baseline of a 10% reduction.[9] Figure 2.8 shows the dynamic changes in bank shares and equilibrium interest rates for one economic region after the policy shock. We find that banks with a higher cost of funding see their market shares dramatically decrease, as consumer switch to banks that offer lower interest rates. Banks strategically react to consumer switching in two ways. First, banks that are losing market power, also reduce their interest rates to be more competitive, whereas banks where consumers are switching

[9]We use different shocks and find that the size of the drop mostly determines the velocity of convergence and not the parameters the model converges to.

to, increase interest rates as they gain market power. In the long run, a ten percent drop in switching frictions translates into a 7.7 percent decrease in interest rates. For a level of 24 percent average, as we have in our economy, this would imply a long-term reduction of around 180 basis points. We evaluate how this rate reduction affects consumer welfare, and we find an improvement of the order of 14 percent (figure 2.7). We also observe convergence in interest rates, which suggests that consumers are comparing rates across lenders.

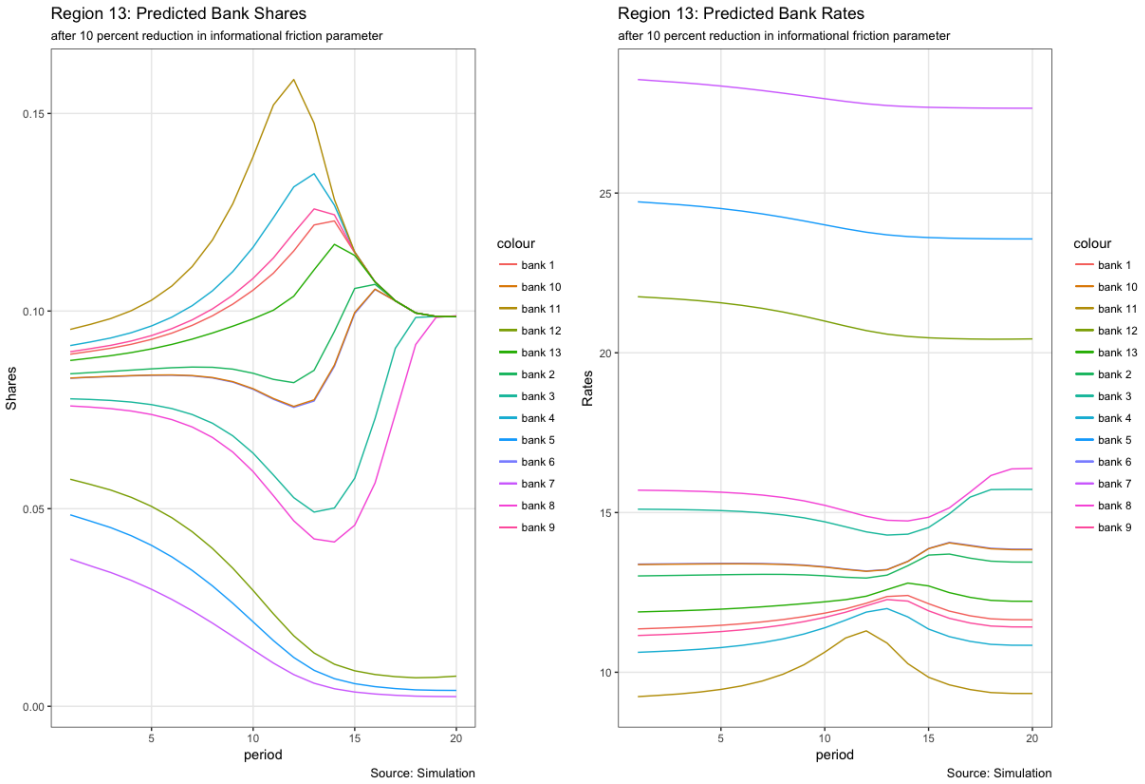
Figure 2.7: Simulations: Weighted Average Interest Rate and Standard Deviation



Simulated evolution for region 13 after 10 percent decrease in informational friction parameter.

Overall, the benefits of interest rate reduction accrue mainly to clients that decided to switch banks. Thus, we find distributive effects between consumers that actively react to price differences and those choose to change banks and the inactive consumers that are not sensitive to relative prices. In the new steady state of our simulated economy, the change in interest rates come from changes in competitive power (mark-ups) as banks? funding remains unchanged. This implies that market power can reduce the economic gains from consumers

Figure 2.8: Simulations: Predicted Shares and Rates by Bank



Simulated evolution for region 13 after 10 percent decrease in informational friction parameter.

re-allocating their loans across financial institutions, as banks that consumers switch to end up raising their rates due to their increased market power. As market conditions and market power attenuate these interventions, we find that the effects of transparency on credit outcomes vary from region to region. Figure 2.9 shows the long-term equilibrium effects we calculate for different regions. In some regions, interest rates dropped by 96 basis points, while in others they drop by 160 basis points. So while the overall rates may improve, these benefits are concentrated to consumers that switch banks and live in regions with more competitive banking sectors.

2.6. Conclusion

We exploit a policy change in Chile that reduced the informational friction component of switching costs for consumers. Using administrative loan-level data in combination with a dynamic structural model, we find that this introduction of a standardized loan contract reduces average interest rates by 180 basis points. Additionally, we observe a reduction across the standard deviation of average rates, which also suggests that search costs decreased for consumers. These rate decreases are attenuated for non-switchers and for consumers in re-

Figure 2.9: Simulations: Summary of Results

	Simulated after 10 percent Drop in C		
	Weighted Average Rate (%)	Average Rate (%)	Consumer Welfare Change (%)
Region 1	-7.75	1.14	14.24
Region 2	-7.83	1.23	14.57
Region 3	-7.35	1.07	13.98
Region 4	-8.72	1.41	13.5
Region 5	-7.66	1.1	14.44
Region 6	-7.75	1.21	13.87
Region 7	-8.62	1.33	14.04
Region 8	-6.89	1.02	15.31
Region 9	-8.5	1.24	14.34
Region 10	-6.69	0.96	13.78
Region 11	-7.86	1.1	14.12
Region 12	-10.58	1.53	13.9
Region 13	-7.73	1.1	15.31
Region 14	-7.46	1.14	14.39
Region 15	-10.39	1.59	14.04
avg	-8.12	1.21	14.26
Parameters: C=16.05, nu = 3.4, rho = 0.04, beta = 0.95			

After 10 percent drop in informational friction parameter

gions that have less competitive banking sectors. As well, for consumers that switch to banks with growing market shares may experience an increase in rates as the bank compensates for increased demand with higher rates. However, overall consumers enjoyed an increase in welfare of 15 percent.

Further work will center on further examining the heterogeneity of responses to the disclosure legislation across types of consumers. In particular, we are interested in how education affects how much consumers react to disclosure and which kinds of disclosures they react to. Additionally, we hope to expand the model to describe how changes in disclosure can affect consumer demand for credit.

Chapter 3

The Effect of Competition on University Tuition

Abstract

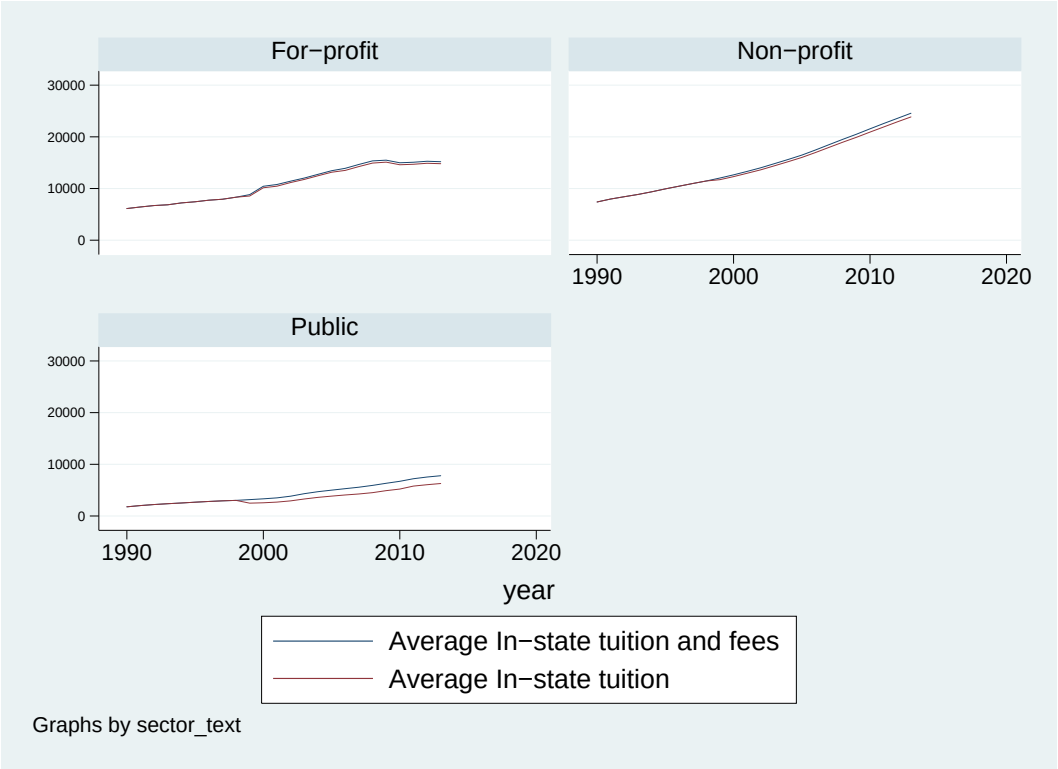
This paper uses tuition freezes on public schools in six states to examine nonprofit universities' tuition reactions to this imposed constraint on their competitor public school. Evidence from both an event study and an instrumental variables approach shows that nonprofit universities do not change their prices in response to tuition freezes by comparable public schools. In contrast, for-profit universities decrease their prices by roughly $1,000. This suggests that competition between universities puts downward pressure on prices for for-profit schools but not nonprofit schools.

3.1 Introduction

Tuition has almost quadrupled for both public and private four year universities over the last two decades (see figure 3.1), leading to concerns about whether university is affordable for households (Lowrey 2014). Accounts in both the academic literature and the popular press seek to explain why tuition has increased so much in such a short span of time. There are two general explanations for these increases: the 'fundamentals' explanations and the 'surplus extraction' explanations.

The 'fundamentals' justification argues that tuition has been increasing due to an increase in demand for higher education and because of increases in costs to supplying higher education. One of the major factors has been the increase in the return on university education. If a university education becomes more valuable, then people's willingness to pay should be higher. This can be seen in *The Economist*'s examination of payscale returns to different university degrees. The Washington Post has a series showing that administration and student services costs have increased at schools. Because students have preferences for these features,

Figure 3.1: In-state Tuition 1990-2013



increases in tuition reflect the increased costs that universities must pay for providing these services. Related to this, it could be that students have preferences for other non-academic related university expenditures such as athletic facilities. Indeed, Jacob, McCall, and Stange 2013 finds that academically weaker but wealthier students value these features in admissions decisions. Similarly, Bound, Hershbein, and Long 2009 find that demand for a university education, in particular a selective four year education has been increasing from 1992 to present, around the time of the most dramatic increases in figure 3.1. Hoxby 1997 presents descriptive reasons why decreases in transportation costs would lead to more competition between schools. This would lead to a stricter hierarchy in school quality, and consequentially, tuition prices, which says that competition between univerisites should lead to higher tuition prices.

The second explanation is the 'surplus extraction' justification. This hypothesis states that the cost of education is rising because of an increased supply of educational credit. This is expressed in the literature as the Bennett hypothesis: when education credit supply increases, universities use their market power to extract that surplus in the form of higher tuition. Cellini and Goldin 2014 find that two year for-profit schools whose students have access to Title IV funding charge 75% higher tuition than comparable schools without access

to this funding. Stolper 2014 finds that when Texas households were allowed to take out home equity lines of credit (HELOCs), selective Texas private schools increase their tuition prices by $2,000. Lucca, Nadauld, and Shen 2015 in preliminary findings have found that certain schools' (mostly for-profit) tuition increased substantially following changes to Stafford loan limits. Lastly, Lau 2014 and Fillmore 2014 use structural models to measure the surplus extracted from students by schools. Lau 2014 finds that for-profit schools capture 57% of the pass-through of loans and grants and Fillmore 2014 finds that non-profit schools extract 70% of match surplus from students.

Despite the growing literature on the determinants of tuition prices, little research has investigated forces that could mitigate rising tuition. Competition is one of the fundamental economic mechanisms that check rising prices. If universities are competitive price-takers they will set tuition at marginal cost. This would mean that the increases we see in tuition are related to 'fundamentals'. In contrast, if universities are somewhat monopolistic and do not compete on price, tuition prices could rise due to surplus extration. My findings demonstrate the limits of competition in higher education: specifically, nonprofit schools are not sensitive to changes in tuition pricing by public schools. My research suggests that upward pressures on tuition, such as fundamentals and surplus extraction, are at best part of the story; we must also investigate the competitive pressures that could dampen tuition growth. My paper is also one of the first to investigate tuition pricing for four year schools. So far, much of the empirical research on tuition pricing has come from two year schools (Cellini and Goldin 2014, Deming and Walters 2015) and relatively little is known about how four year colleges set prices (Fillmore 2014).

Public school tuition freezes offer an opportunity to study competition between public and private institutions. To examine the impact of these freezes, I use two identification strategies: the first is a standard event study. The second uses an instrumental variables approach to determine how much a private school's tuition moves with comparable public schools' tuitions. Fortunately, these identification strategies allow me to remain largely agnostic about a difficult question: the structure of a university's objective function. I assume only that public and private schools compete for in-state students.

The rest of the paper is organized as follows. Section 2 describes the data. Section 3 explains and presents the results of my two identification strategies. Section 4 discusses how to extend these results and their significance for research and policy.

3.2 Data

The data come from the Integrated Postsecondary Education Database System (IPEDS), which is collected by the National Center for Education Statistics from university administrators. The sample is from 1990-2013 and includes tuition information on roughly 650 public schools, 1,400 non-profit schools, and 520 for-profit schools, for roughly 51,000 observations.

IPEDS distinguishes between three types of schools, one public and two private. Public schools such as those in the University of California system are subject to the influence of

state legislatures, though operate mostly independently. Private schools fall into two categories: nonprofit and for-profit schools. For-profit schools such as those in the Corinthian group have an explicit goal of profit maximization and are sometimes publicly traded. Nonprofit schools such as Pomona College do not have a profit objective, but may maximize other objectives such as the quality of education, and research output of the university. While most press attention has been devoted to two year for-profit schools, there are four year for-profit schools as well.

As can be seen from Tables 3.1-3.3, in-state public school tuition ($4,000) is much lower than in-state tuition at for-profit ($13,000) or non-profit schools ($15,000). However, out-of-state pubilc school tuition ($12,800) is more comparable with out-of state tuition at for-profit ($18,000) and non-profit ($13,800) institutions.

A proper interpretation of these comparisons must account that the price of a university is not as straightforward as the price of a product. The "sticker price" is the price listed in a university's official documentation. The "net price" is what students actually pay for their education (i.e. the sticker price minus grants), and can often be substantially lower than the sticker price. Although non-profit schools have the highest sticker prices, they also provide the most generous institutional grants: 72% of students at these schools receive grants, with the average grant at $8,500. These grants make the average cost of a non-profit only $3,000-4,000 per year more than a full-price public school. Approximately one third of students at public schools receive institutional grants, but the average grant is only $3,000. For-profit schools are the least generous with grants, with only 16% of students receiving grants and the average grant is $2,000. The importance of institutional grants for non-profit schools suggest that net price will be an important consideration when examining whether schools compete on price. For now, however, I refer to tuition as sticker price, and leave net price for future research.

As tuition prices are important to calculate borrowing limits, it is not surprising that 60% of non-profit students take out loans and the average amount is $5,000. Slightly less than half of public school students take out loans and the average loan is roughly $4,000. Three quarters of for-profit students take out loans of approximately $7,000 each. Roughly 85% of public and for-profit students are from in-state, which suggests they might be substitutes to each other. This could be less true for non-profit schools that draw 40% of their incoming class from other states.

Table 3.1: Summary Statistics: Public Schools

	count	mean	sd	min	max
In-state tuition and fees	15,451	4,300	2,671	0	22,997
YoY change in-state	14,730	265	364	-12,443	11,289
Out-of-state tuition and fees	9,687	12,820	5,844	0	41,811
YoY changeout-of-state	9,006	674	1,099	-13,252	13,185
Pct with inst. grants	8,654	33	22	0	100
Pct with loans	8,654	47	22	0	100
Avg amt inst. grants	8,451	2,920	1,856	0	15,362
Avg amt loans	8,486	4,336	1,741	0	14,423
SAT verbal 25th ptile	5,463	461	54	200	670
SAT verbal 75th ptile	5,464	568	56	307	800
SAT math 25th ptile	5,510	472	61	200	700
SAT math 75th ptile	5,510	581	61	300	800
Percentage out-of-state	10,454	15	19	0	100
Percentage in-state	9,788	84	16	3	100
Percentage foreign	7,651	2	3	0	87
Observations	15505				

Numbers not adjusted for inflation. Four year schools only.

Table 3.2: Summary Statistics: Non-profit Schools

	count	mean	sd	min	max
In-state tuition and fees	30,733	14,864	9,059	0	49,138
YoY change in-state	28,999	780	887	-26,392	42,750
Out-of-state tuition and fees	19,519	17,958	9,475	0	49,138
YoY changeout-of-state	18,031	909	1,011	-26,392	42,750
Pct with inst. grants	17,441	72	30	0	100
Pct with loans	17,441	60	26	0	100
Avg amt inst. grants	16,693	8,510	6,386	0	41,400
Avg amt loans	16,313	5,349	2,397	0	25,875
SAT verbal 25th ptile	10,062	484	74	0	799
SAT verbal 75th ptile	10,061	596	72	0	800
SAT math 25th ptile	10,119	486	79	0	799
SAT math 75th ptile	10,116	597	73	0	800
Percentage out-of-state	19,534	35	27	0	100
Percentage in-state	17,784	59	27	0	100
Percentage foreign	11,602	5	9	0	100
Observations	31164				

Numbers not adjusted for inflation. Four year schools only.

Table 3.3: Summary Statistics: For-profit Schools

	count	mean	sd	min	max
In-state tuition and fees	8,004	12,164	5,129	0	65,711
YoY change in-state	7,318	347	1,910	-35,806	36,061
Out-of-state tuition and fees	5,961	13,819	4,732	0	65,711
YoY changeout-of-state	5,399	342	2,128	-35,806	36,061
Pct with inst. grants	5,723	16	23	0	100
Pct with loans	5,743	73	26	0	100
Avg amt inst. grants	4,249	1,924	2,076	0	31,630
Avg amt loans	5,553	7,369	3,490	0	86,971
SAT verbal 25th ptile	101	443	57	257	620
SAT verbal 75th ptile	100	558	59	450	772
SAT math 25th ptile	101	439	63	223	650
SAT math 75th ptile	100	552	61	430	690
Percentage out-of-state	5,745	13	22	0	100
Percentage in-state	5,260	85	22	0	100
Percentage foreign	738	6	12	0	96
Observations	8496				

Numbers not adjusted for inflation. Four year schools only.

Figure 3.2 provides suggestive evidence of competition in non-profit sticker prices for tuition and fees. The most exclusive schools seem to cluster around $45,000, while the very selective schools seem to have more of a normal distribution around $25,000 and a more uniform distribution centered around $20,000 for inclusive schools. This suggests that non-profit schools that are not maximally exclusive may compete with each other, or with public schools. The patterns in the for-profit university tuition prices are less clear because there are so few four-year for-profit schools. For example, there is only one "most selective" for-profit school. Price dispersion seems to decrease in selectivity, although all the distributions seem to be centered around $14,000. However, in earlier time periods (such as the early and mid 2000s) there was less clear clustering around one price for the most selective schools, which suggests that they may be increasing their market power and/or relying more on financial aid to be affordable to students.

3.3 Identification

Tuition Freezes

Six states implemented "tuition freezes" between 1990 and 2013, and the average span of a freeze was three years. Such freezes are implemented at the state level, and prohibit public

Figure 3.2: Non-profit In-state Tuition and Fees 2013

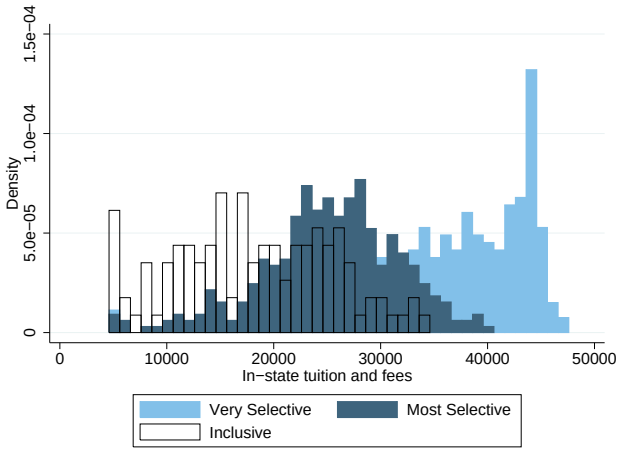
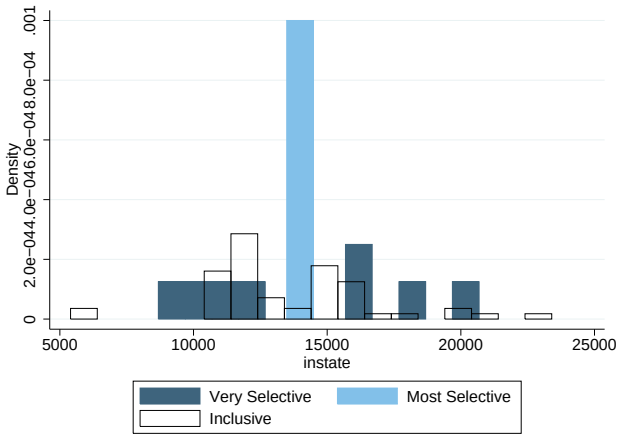


Figure 3.3: For-profit In-state Tuition and Fees 2013



schools from raising tuition prices beyond the amount at a base year (usually the year after a freeze is announced). I use tuition freezes as an exogenous experiment on non-profit and for-profit schools. For example, consider how a tuition-freeze in California might affect Pomona College (located near Los Angeles) versus Boston University. Assuming that Pomona College competes for in-state students with California public schools, we might expect Pomona to curtail its tuition increases relative to Boston University.

For the purposes of my identification strategies, the experiment must be exogenously applied only to private schools, not necessarily public to ones. Indeed, it is likely that freezes are not exogenously assigned to public public schools. Consider that states with higher or faster-rising public tuition might experience political pressure to freeze tuition. For example, prior to the Oregon freeze between 1997-1999, students pushed a freezer down

the I-5 to protest rising tuition. However, my treatment is plausibly exogenous to private school pricing, which is all that is required for my identification strategies.

To examine the impact of tuition freezes, I use two identification strategies. The first is a standard event study across public, non-profit, and for-profit schools. The second is an instrumental variables approach, meant to obtain the direct effect of growth in public school prices on growth in private school prices.

Table 3.4: Tuition freezes 1990-2013

State	Years in effect	Public schools	Schools in state
New York	1995-2002	43	201
Oregon	1997-1999	8	37
Missouri	2009-2010	14	87
Kansas	2009	8	35
Maryland	2006-2009	14	41
California	2011-2013	36	232

Event Study

The event study allows us to see the impact of the freeze on the different types of schools. I use the below specification (equation (3.1)), where y_{it} is the level of in-state tuition, α_i and γ_t are school and year fixed effects, $F_{s(i),t+k}$ is the freeze indicator variable and δ^k is the effect of the freeze on the level of tuition. The sample includes all universities in states that eventually experienced a freeze, and results are robust to including schools that did not experience a freeze.

$$y_{it} = \alpha_i + \gamma_t + \sum_{k=-5}^{5} \delta^k F_{s(i),t+k} + \epsilon_{it} \tag{3.1}$$

For public schools, we see that the schools tend to be lower priced leading up to a freeze, though their tuition is rising. The rise in tuition suggests that these freezes might be politically motivated, and thus not exogenously applied to public schools. The rapid rise of tuition the year after the freeze is indicative of universities increasing their prices between when a freeze is announced and when it is implemented (i.e. a freeze may be announced in 2006, but only applies to 2007 when tuition prices must remain at 2006 levels). After this rise, we see that tuition for public schools decreases, though remains comparable to schools that do not have a freeze.

For nonprofit schools, we see that these schools did not appreciably change their tuition prices either in anticipation or after the freezes. In contrast, for-profit schools tended to have higher prices than comparible for-profit schools in states that were non-frozen prior to

Figure 3.4: Event study - public

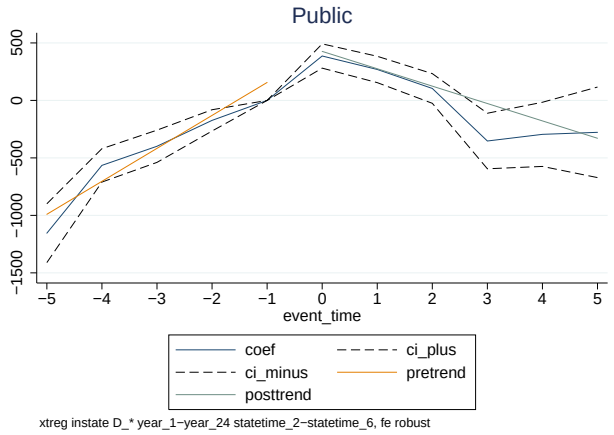
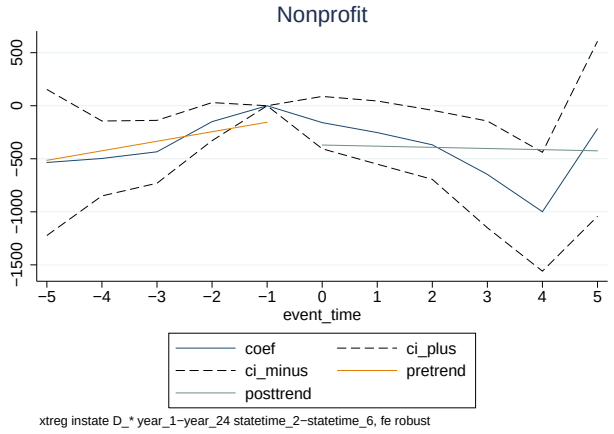


Figure 3.5: Event study - nonprofit



freezes. After the freeze, these schools decreased their prices by roughly $1,000, in line with for-profit schools in states that were not frozen at the time.

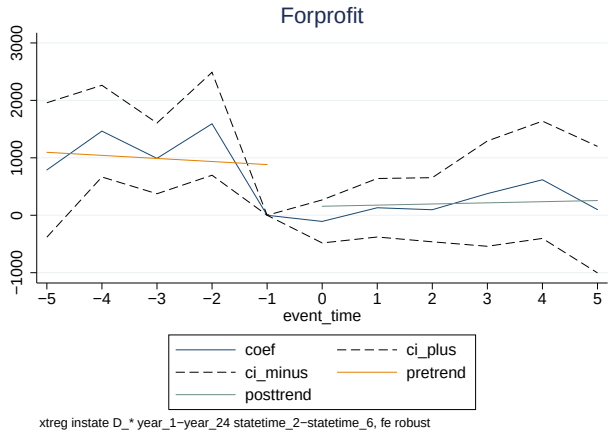
Instrumental Variables Specification

Ideally, to find the direct effect of how much public school tuition influences private tuition, we would like to run a regression (3.2)

$$privatetuition_{it} = \alpha + \beta publictuition_{it} + \upsilon_{it} \tag{3.2}$$

If β is positive (private school tuition goes up when public school tuition goes up and vice versa), then we could determine that private and public schools compete. However, there

Figure 3.6: Event study - for-profit



could be potentially many omitted variables that might make public and private school tuition increase at the same time, such as an increase in demand for a university education in general as seen in (Bound, Hershbein, and Long 2009), that a simple OLS regression would mistakenly suggest schools compete when they do not.

When a state experiences a freeze, these satellite campuses are then 'treated'. If one school draws many students from a freeze state, arguably they are more treated than a school that draws relatively fewer students from those states. Thus, the instrument is the weighted exposure to the freezes in each state ($\Sigma\omega_{is,1992}Freeze_{s(i)\tau}$) (equation (**??**)), and can be thought of as a treatment dose. The second stage, (equation (**??**)) reflects how private school tuition changes in response to competition from its closest public school. The inclusion restriction is that the 'counterfactual public school' is affected by exposure to freezes, and the exclusion restriction is that freezes affect private school tuition only through public school tuition responses.

Table 3.5: IV In-state Non-profit

	(1) Public Tuition Growth	(2) Tuition growth
Exposure	-0.0213***	
	(0.00407)	
Public Tuition Growth		0.211
		(0.115)
Year	Y	Y
F	30.00	24.62
N	28969	28969
Cluster	State	State

Weights used are the fraction of students that come from different states at each school as of 1992. Standard errors are clustered at the state level and robustly estimated.

The results in table 3.5 suggest that while the counterfactual public schools are affected by exposures to tuition freezes, nonprofit school tuition does not seem to correlate with the price growth of comparable public school tuition. Thus, nonprofit schools do not compete on price with public schools.

3.4 Conclusion and Next Steps

My preliminary results suggest that non-profit universities do not compete with public universities on sticker price, while for-profits might. Further extensions to this paper hope to test if this is true for net price as well, or if schools are competing on some other dimension such as educational quality (such as educational quality). It will also be useful to more finely define what schools compete with each other – currently, I assume that schools compete if they are in a freeze state, or if they draw students from that state.

Imagine a committee that sets out to discover why astronauts can jump so high on the moon. The debate centers on two factors that might propel them upwards: athletic ability versus specialized equipment. Surely another part of the story is that there is minimal gravity to keep astronauts down. Similarily, tuition may be rising not only because of factors that push it upwards, but also because there are minimal competitive pressures to keep prices down.

Bibliography

Abaluck, Jason and Jonathan Gruber (2011). "Choice inconsistencies among the elderly: evidence from plan choice in the Medicare Part D program". In: *American Economic Review* 101.4, pp. 1180–1210.

Agarwal, Sumit et al. (2014a). "Regulating consumer financial products: Evidence from credit cards". In: *The Quarterly Journal of Economics* 130.1, pp. 111–164.

— (2014b). "Regulating consumer financial products: Evidence from credit cards". In: *The Quarterly Journal of Economics* 130.1, pp. 111–164.

Ali Hortaçsu, Chad Syverson. "Product Differentiation, Search Costs, and Competition in the Mutual Fund Industry: A Case Study of S&P 500 Index Funds". In: *The Quarterly Journal of Economics* 119.2, pp. 403–456.

Argyle, Bronson et al. (2016). "Credit Constraints and Search Frictions in Consumer Credit Markets". In:

Artuç, Erhan, Shubham Chaudhuri, and John McLaren (2010). "Trade shocks and labor adjustment: A structural empirical approach". In: *American economic review* 100.3, pp. 1008–45.

Baye, Michael R and John Morgan (2001). "Information gatekeepers on the internet and the competitiveness of homogeneous product markets". In: *American Economic Review* 91.3, pp. 454–474.

Baye, Michael R, John Morgan, Patrick Scholten, et al. (2006). "Information, search, and price dispersion". In: *Handbook on economics and information systems* 1, pp. 323–375.

Bergstresser, Daniel, John MR Chalmers, and Peter Tufano (2009). "Assessing the costs and benefits of brokers in the mutual fund industry". In: *The Review of Financial Studies* 22.10, pp. 4129–4156.

Berry, Steven T (1994). "Estimating discrete-choice models of product differentiation". In: *The RAND Journal of Economics*, pp. 242–262.

Bertrand, Marianne and Adair Morse (2011). "Information disclosure, cognitive biases, and payday borrowing". In: *The Journal of Finance* 66.6, pp. 1865–1893.

Bertrand, Marianne et al. (2010). "What's advertising content worth? Evidence from a consumer credit marketing field experiment". In: *The Quarterly Journal of Economics* 125.1, pp. 263–306.

Bound, John, Brad Hershbein, and Bridget Terry Long (2009). *Playing the admissions game: student reactions to increasing college competition*. Tech. rep. National Bureau of Economic Research.

Brown, Jennifer, Tanjim Hossain, and John Morgan (2010). "Shrouded attributes and information suppression: Evidence from the field". In: *The Quarterly Journal of Economics* 125.2, pp. 859–876.

Cellini, Stephanie Riegg and Claudia Goldin (2014). "Does Federal Student Aid Raise Tuition? New Evidence on For-Profit Colleges." In: *American Economic Journal: Economic Policy* 6.4, pp. 174–206.

Chioveanu, Ioana and Jidong Zhou (2013). "Price competition with consumer confusion". In: *Management Science* 59.11, pp. 2450–2469.

Christoffersen, Susan EK and David K Musto (2002). "Demand curves and the pricing of money management". In: *The Review of Financial Studies* 15.5, pp. 1499–1524.

Degryse, Hans and Steven Ongena (2005). "Distance, lending relationships, and competition". In: *The Journal of Finance* 60.1, pp. 231–266.

Deming, David J. and Christopher Walters (2015). *Should Community College be Free? Supply and Demand in the Market for U.S. Higher Education*. Tech. rep. Working paper.

Ellison, Glenn and Alexander Wolitzky (2012). "A search cost model of obfuscation". In: *The RAND Journal of Economics* 43.3, pp. 417–441.

Farrell, Joseph and Paul Klemperer (2007). "Coordination and lock-in: Competition with switching costs and network effects". In: *Handbook of industrial organization* 3, pp. 1967–2072.

Ferman, Bruno (2015). "Reading the Fine Print: Information Disclosure in the Brazilian Credit Card Market". In: *Management Science* 62.12, pp. 3534–3548.

Fillmore, Ian (2014). "Price Discrimination and Public Policy in the US College Market". In:

Gabaix, Xavier and David Laibson (2006). "Shrouded attributes, consumer myopia, and information suppression in competitive markets". In: *The Quarterly Journal of Economics* 121.2, pp. 505–540.

Ginger Zhe Jin Michael Lucca, Daniel Martin (2018). "Complex Disclosure". In: *Manuscript*.

Green, Richard C, Burton Hollifield, and Norman Schürhoff (2006). "Financial intermediation and the costs of trading in an opaque market". In: *The Review of Financial Studies* 20.2, pp. 275–314.

Grubb, Michael D (2015). "Behavioral consumers in industrial organization: An overview". In: *Review of Industrial Organization* 47.3, pp. 247–258.

Handel, Benjamin R (2013). "Adverse selection and inertia in health insurance markets: When nudging hurts". In: *American Economic Review* 103.7, pp. 2643–82.

Hoxby, Caroline M (1997). *How the changing market structure of US higher education explains college tuition*. Tech. rep. National Bureau of Economic Research.

Illanes, Gast'on (2016). *Switching Costs in Pension Plan Choice*. Tech. rep. Working Paper.

Jacob, Brian, Brian McCall, and Kevin M Stange (2013). *College as Country Club: Do Colleges Cater to Students' Preferences for Consumption?* Tech. rep. National Bureau of Economic Research.

Kim, Moshe, Doron Kliger, and Bent Vale (2003). "Estimating switching costs: the case of banking". In: *Journal of Financial Intermediation* 12.1, pp. 25–56.

Kling, Jeffrey R et al. (2008). "Misperception in choosing Medicare drug plans". In: *Unpublished manuscript*.

Lau, Christopher V (2014). "The Incidence of Federal Subsidies in For-profit Higher Education". In:

Lowrey, Annie (2014). "Changed Life of the Poor: Better Off, but Far Behind". In: *New York Times*.

Lucca, David O, Taylor Nadauld, and Karen Shen (2015). "Credit supply and the rise in college tuition: evidence from the expansion in federal student aid programs". In: *FRB of New York Working Paper No. FEDNSR733*.

Luco, Fernando (2013). "Switching costs and competition in retirement investment". In: *The Center for the Study of Industrial Organization-Northwestern University. The Center for the Study of Industrial Organization-Northwestern University*.

Shy, Oz (2002). "A quick-and-easy method for estimating switching costs". In: *International journal of industrial organization* 20.1, pp. 71–87.

Stolper, Harold (2014). "Home Equity Credit and College Access: Evidence from Texas Home Lending Laws". In:

Woodward, Susan E and Robert E Hall (2010). "Consumer confusion in the mortgage market: Evidence of less than a perfectly transparent and competitive market". In: *American Economic Review* 100.2, pp. 511–15.

Zaki, Mary (2018). "Interest Rates: Prices Hidden in Plain Sight". In: *Manuscript*.