Repossession and the Democratization of Credit

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We exploit a 2004 credit reform in Brazil that simplified the sale of repossessed cars used as collateral for auto loans. We show that the reform expanded credit to riskier, self-employed borrowers who purchased newer, more expensive cars. The legal change has led to larger loans with lower spreads and longer maturities. Although the credit reform improved riskier borrowers' access to credit, it also led to increased incidences of delinquency and default. Our results shed light on the consequences of a credit reform and highlight the crucial role that collateral and repossession play in the liberalization and democratization of credit. (*JEL* G32, G33, K12, K40)

Perhaps the most important legal feature of debt contracts is the lender's right to repossess assets when borrowers default on promised payments. The legal right to repossess collateral is critical to the provision of credit because it allows creditors to recover, at least partially, the value of their loans. We show how a 2004 credit reform that simplified the selling of repossessed cars led to the liberalization of the auto loan credit market in Brazil. Our evidence suggests that the reform expanded credit to riskier, self-employed borrowers who purchased

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newer, more expensive cars. Moreover, the legal change has led to larger loans with lower spreads, longer maturities, and higher leverage.

The development of the Brazilian auto loan market faced several impediments. Chief among them was the inefficient process of repossession and resale of autos when borrowers defaulted on their loans. Banks were allowed to repossess the autos of borrowers who failed to repay their loans. However, the banks could not resell these repossessed cars without court approval. As a result, the time from the repossession of a car to its resale by the bank averaged more than two years. In August 2004, the Brazilian government announced a broad credit reform that, among other legal changes, eased the resale of repossessed autos.

We find that the ability to resell collateral affected the composition of borrowers in the auto loan market. Because implementation of the reform dramatically expedited the process of reselling repossessed cars, expected loss given default from a car loan declined sharply. As a result, borrowers with a higher probability of default would be expected, ex ante, to be more likely to obtain an auto loan. Our regression analysis shows that the reform enabled riskier, self-employed, and, in some circumstances, low-income borrowers to obtain loans and purchase newer, more expensive cars. These results demonstrate a process known as the "democratization of credit"—in which the banks' ability to repossess and resell collateral led to an expansion of credit to borrowers who were formerly less likely to obtain loans.

Our results support the notion that the ability to pledge collateral led to the expansion of credit to borrowers whose loans applications had been previously denied. In particular, our empirical evidence is consistent with the model by Jappelli, Pagano, and Bianco (2005), who show that improvements in the ability to collect collateral—which de facto raises collateral values—reduce credit constraints and increase lending by opening the market to lower-grade borrowers.

Although better recovery of collateral leads to increased supply of external finance, its effect on financial contracts is ambiguous. On one hand, increased recovery of collateral induces banks to offer larger loans with lower credit spreads and longer maturities. On the other hand, increased recovery rates enable riskier borrowers who were previously rejected and rationed out of the market to obtain credit. Whereas enhancing the ability of banks to recover their loans leads to better contracts for existing borrowers, banks will offer smaller loans, with higher credit spreads and shorter maturities, to the newly admitted cohort of riskier borrowers.

We use microlevel data from one of the largest banks in Brazil to provide direct evidence on the consequences of the reform. Our data enable us to separate the direct effect of the legal change on contracts from the composition effect that results in increased lending to riskier borrowers. We show that, consistent with Jappelli, Pagano, and Bianco (2005), the reform brought about an expansion of credit, enabling riskier, low-income borrowers to obtain loans

and purchase newer, more expensive cars. We refer to this effect as the "democratization of credit," in which the strengthening of the ability of lenders to foreclose, repossess, and sell assets increases the supply of credit to those who need it most.

Using detailed information on a large sample of auto loans made by one of Brazil's largest banks from the years 2003 to 2005, we also study the relation between the bank's ability to seize and resell collateral and financial contracts. Consistent with predictions from the financial contracting literature (Shleifer and Vishny 1992; Hart and Moore 1994), our analysis shows that the credit reform in Brazil led to larger loans with lower spreads, longer maturities, and higher leverage.

Further, we study the consequences of the reform for loan performance. A growing body of empirical evidence suggests that credit expansion leads to subsequent waves of default and repossession (Keys et al. 2010; Mian and Sufi 2009, 2010). Given that we find that the reform led to lending to riskier borrowers, it is likely that loans granted after the reform will have a higher rate of default. We find that the likelihood of a late payment and default increased after the law was implemented.

Although our identification strategy hinges on the notion that our results are driven only by the time-series change in the law, other important polices that affect credit markets also change over time and potentially coincide with our time-series measure of the reform. Our analysis controls for such macrovariables as the federal funds rate, inflation, and GDP growth, but it is possible that unobserved contemporaneous shocks affected car loans through channels other than the law.

To alleviate concerns about the validity of our identification strategy, we add a cross-sectional dimension to the analysis by augmenting the data on car loans with information on other personal loans. Using a matched sample of personal loans made between August 2003 and July 2005, we estimate the effect of the reform on borrower characteristics using a difference-in-differences specification. Because the legal reform did not apply to personal loans, we can use them as our control group while evaluating the car loans sample. The difference-in-differences estimates demonstrate that the reform had a differential effect on borrowers who took out auto loans by increasing the supply of credit to lower-income, higher-risk, and self-employed borrowers.

We conduct additional cross-sectional tests by utilizing information on the age of the car underlying the loans. Some asset types, such as cars, are subject to an accelerated depreciation in which they lose more of their value up-front. Whereas the legal reform applies to all auto loans, we would expect loans on new cars to be affected more than those backed by older cars. Whereas before the reform it took banks about two years to resell repossessed cars regardless of their age, newer cars can be expected to lose more of their collateral value earlier on, which should affect the terms of loans secured for new cars more

than those secured for used autos. Consistent with this prediction, we find that the effect of the reform on credit spreads is higher for new cars compared to used cars. We obtain similar results for each of the other dimensions of the contract. The law prolongs loan maturities and increases loan amounts for new cars while having a smaller effect on loans secured for used cars.

Our paper is related to the vast body of theoretical literature on the role of collateral in secured lending (Bester 1985; Johnson and Stulz 1985; Boot and Thakor 1991; Aghion and Bolton 1992; Hart and Moore 1994; Bolton and Scharfstein 1996; Hart and Moore 1998; Eisfeldt and Rampini 2009; Rampini and Viswanathan 2010) and to the empirical evidence on the effect of collateral on financial contracts and lending (Berger and Udell 1990; John, Lynch, and Puri 2003; Benmelech, Garmaise, and Moskowitz 2005; Jimenez, Salas, and Saurina 2006; Benmelech and Bergman 2008, 2009; Benmelech 2009; van Binsbergen, Graham, and Yang 2010; Benmelech and Bergman 2011; Vig 2011).

The rest of the paper is organized as follows: Section 1 discusses the theoretical literature on collateral and credit. Section 2 describes the institutional details of the credit reform in Brazil. Section 3 describes our data sources and summary statistics. Section 4 presents the empirical analysis. Section 5 concludes.

1. Collateral and the Provision of Credit

Why do borrowers pledge collateral? Models that are based on adverse selection and asymmetric information typically predict that high-quality borrowers will pledge collateral, whereas low-quality borrowers will use unsecured loans.[1] Whereas Stiglitz and Weiss (1981) show that adverse selection can lead to credit rationing, Wette (1983) and Bester (1985) argue that collateral can be used as a sorting device, thereby preventing the rationing of credit. For example, in Bester (1985), lenders offer loan contracts with different collateral requirements, and the optimal contract is the one in which risky borrowers pay a higher interest rate but do not post collateral, whereas safer borrowers put down collateral and pay a lower interest rate. This signaling is made possible because posting collateral is less costly for higher-quality borrowers, because the likelihood that they will default and lose their collateral is lower. Other adverse selection models yield similar predictions on the association between the borrower's quality and the degree of collateralization (Chan and Kanatas 1985; Besanko and Thakor 1987a, 1987b; Chan and Thakor 1987).

In contrast to the predictions made by adverse selection and asymmetric information theories, models that are based on symmetric information and moral hazard predict that only bad borrowers pledge collateral (Berger and Udell 1990; Boot, Thakor, and Udell 1991). According to Tirole (2005), "Under

[1] Our discussion here closely follows Benmelech and Bergman (2009).

symmetric information and moral hazard, it may be the case that only a bad borrower pledges collateral; for a borrower may need to make up for his lack of pledgeable income by offering some costly collateral."[2] The empirical evidence (Berger and Udell 1990, 1995; Booth 1992; Jimenez, Salas, and Saurina 2006) is consistent with moral hazard models and has documented both that low-quality firms are more likely to post collateral and that collateralized loans are perceived to be riskier, owing to the lower quality of the borrowers using these loans.

Although collateral can be used to alleviate financial frictions stemming from moral hazard and adverse selection effects, there are costs that are associated with collateralization. One example of such costs is the inefficient process of repossession and resale of autos in Brazil before August 2004. Indeed, according to Tirole (2005), "There may be ex ante and ex post transaction costs involved in including liens into loan contracts, in recovering the collateralized assets in default, and in selling the asset to third parties (writing costs, brokerage fees, taxes, or judiciary costs). For example, countries differ in the efficiency and honesty and their courts. Slow trials and uncertainty about how much lenders will recoup in the judiciary process may make them discount the value of collateral, reducing both the borrower's ability to raise funds, and destroying value even if the borrower succeeds in securing loans."[3]

Similarly, Jappelli, Pagano, and Bianco (2005) develop a model that analyzes the effect of judicial enforcement of debt contract on the amount of lending, interest rates, and default rates. Their definition of judicial efficiency—the fraction of collateral that lenders can expect to recover at the end of a trial—is closely related to the Brazilian auto reform we study in this paper. According to Jappelli, Pagano, and Bianco (2005), an improvement in the ability to recover collateral unambiguously increases aggregate lending by enabling access to credit for borrowers who were previously rationed out. While their model is based on the notion of moral hazard, they obtain results similar to those in the adverse selection analysis of Bester (1985). The ability to pledge collateral and the enhancement of collateral values can alleviate credit rationing.[4]

This leads us to our first prediction.

Prediction 1. A borrower's risk increases as collateral liquidation value increases, all else being equal.

Further, the value of collateral affects all facets of debt contracts. Increases in collateral values will lead to larger debt capacity, longer debt maturity, and lower interest rates (Williamson 1988; Harris and Raviv 1990; Shleifer and Vishny 1992; Hart and Moore 1994). However, the effect of improvement in

[2] See Tirole (2005, 253).

[3] Tirole (2005, 167).

[4] We are grateful to the referee for offering this interpretation of our results.

liquidation values on borrowing terms is ambiguous when borrowers who were previously rationed from credit markets can now obtain loans. For example, Jappelli, Pagano, and Bianco (2005) show that the effect of an improvement in judicial efficiency on average interest rates is ambiguous because increased recovery rates enable riskier borrowers who were previously denied credit. In prediction 2 we extend Jappelli, Pagano, and Bianco's intuition to other contractual terms.

Prediction 2. Interest rates decrease, and debt capacity and maturity increase following the reform for safe borrowers, whereas the effect of the reform on loan terms for risky borrowers is ambiguous, all else being equal.

Finally, because the reform leads to the expansion of credit to individuals who were previously denied credit, the deterioration of the borrower pool will increase the average default rate (see Jappelli, Pagano, and Bianco 2005, 229–30 and their Appendix A).

Prediction 3. Average default rates increase following the reform, all else being equal.

2. Institutional Details

2.1 Background

The development of the Brazilian auto loan market faced several impediments. Chief among them was the inefficient process of repossession and resale of autos when borrowers defaulted on their loans. Brazilian banks could repossess the autos of borrowers who failed to repay their loans. Without court approval, however, banks could not resell these repossessed cars. As a result, the time from repossession of a car to its resale by the bank averaged more than two years. In August 2004, the Brazilian government announced a broad credit reform that, among other legal changes, eased the resale of repossessed autos.[5]

The reform dramatically changed the auto loan market. In 2007 *Veja*, the most popular weekly news magazine in Brazil, wrote that "Brazilians have never bought so many cars. In 2007, it will be 2.5 million units, an unparalleled record for the auto industry. … And there is only one explanation for this: credit. Until recently, in Brazil, credit was scarce and expensive. Now, it is possible to buy a car without a down payment and to finance it for up to seven years with installments below the (monthly) minimum wage."[6]

Before the credit reform, auto financing was not an attractive line of business for banks because of the inefficient legal process in the event of default.

[5] One of the government's official objectives was to reduce costs associated with the recovery rates of auto loans.

[6] "Propulsão a crédito," *Veja*, October 31, 2007.

The credit reform transformed the auto loan market, as *Veja* noted: "The proceedings dragged on for years, and often the judges gave cause to buyers. This situation changed only after the implementation of the 'lei de alienação fiduciária,' a legal institute that provides for the rapid recovery of car financing in case of default." To better understand the changes in the Brazilian credit market, we first describe the auto credit system before the reform.

2.2 The Brazilian auto loan market

We briefly describe the process of obtaining an auto loan in Brazil before moving on to the details of the credit reform. Buyers who need to finance the purchase of a vehicle typically fill out a loan application through an auto dealer. The loan is then submitted for bank review and approval. If the bank approves the application, the dealership handles the loan agreement but is not held liable for the loan. Auto loans can be granted either through *crédito direto ao consumidor* (direct consumer credit) or *arrendamento mercantil* (leasing). Both procedures are similar, and in both cases the purchaser gains ownership of the vehicle only after having fully repaid the loan. Loans are amortized and typically mature in three years, with equal monthly installments. If the borrower defaults on three consecutive payments, the bank issues a report to both the Central Bank of Brazil and the country's largest credit agency, Serasa.[7] The bank may then either attempt to renegotiate the loan or trigger the repossession process.

2.3 The credit reform

Brazilian fiduciary law applied first to capital markets and was later extended to auto and mortgage loans.[8] According to the law, the bank, after granting an auto loan, holds the title to the car until the loan is paid in full. The borrower is entitled to the daily use of the vehicle used as collateral. When the borrower pays all loan installments in accordance with the agreement, the bank transfers the car title to the borrower. In the case of default, the borrower may no longer use the car. The bank can then repossess the vehicle through a court injunction after proving default. Before the reform, however, the bank needed to wait for a court decision in order to resell a repossessed car. During this period the car was stored at a parking facility.

Initial implementation of the default process in the 1960s proceeded smoothly. The legal procedure was fairly short, and the court system could handle the number of cases awaiting trial. Over time, however, the process lengthened. By the late 1990s financial institutions faced lengthy waits for authorization to resell repossessed vehicles. According to a senior Brazilian bank officer, in many cases banks had to wait more than three years.

[7] Serasa is a private bureau. Its role is to maintain a database on the standing of borrowers.

[8] The law was implemented in 1965; it was extended to auto loans in 1969 and to mortgages in 1997.

The inefficient legal system also hurt borrowers. During the time it took to resell cars, borrowers' indebtedness increased at the pace of the loan interest rate, while the value of the underlying collateral, the car, depreciated over time.

The need for reform was indisputable. To remove inefficiencies in the auto loan and other credit markets, the government enacted federal law n.10.931/04, the Lei de Alienação Fiduciária (fiduciary law), which the president signed on August 2, 2004. This legislation, which became effective on its enactment, affected the auto loan, mortgage, and capital markets. Because of an uncertain political climate, the banking system was skeptical about the implementation of the law until it was enacted. There was also considerable uncertainty about the ability of the court system to operationalize the reform.

The most notable changes introduced by the law that apply to the auto loan market concern the authorization to resell a repossessed vehicle. This process became simpler and faster. Amendolara (2006) highlights three differences regarding the process of auto repossession and resale. First, after the bank gets a court injunction to seize the car, the borrower has five days to pay the debt in full and recover possession of the vehicle. Second, the borrower has fifteen days to challenge the court injunction instead of the previously established three days. The main difference in the law s that now the bank may resell the car after this period of fifteen days, where previously it could sell the car only after trial. Third, the borrower has the right to challenge the bank in court. If the bank is found guilty, it must compensate the borrower by an amount equal to 150% of the total loan.

Ultimately, the law has reformulated relationships among borrowers, creditors, and courts. Borrowers and creditors now engage in direct relationships, and courts play a significant role only when borrowers explicitly request it. The law avoids unnecessary trials, reduces the reliance on courts, and increases the enforceability of auto loan contracts.

The new environment marked a dramatic turn for the auto loan market. According to senior officers from a large Brazilian bank, the process of repossession and resale formerly took between two and three years. Now this process takes three weeks. Although some borrowers sue the bank after losing their car, the bank has never been found guilty by the courts. Finally, the supply of credit for auto loans has grown dramatically. According to the Central Bank of Brazil, credit for vehicles grew from R$34.7 billion (US$11.5 billion) in August 2004 to R$60.2 billion (US$27.9 billion) two years later.

3. Data and Summary Statistics

Our proprietary data come from one of the three largest private banks in Brazil.[9] As of December 2010 the combined assets value of these banks—Bradesco,

[9] We are unable to disclose the bank's name.

Itau Unibanco, and Santander—was R$1.7 trillion (US$1 trillion). According to the Central Bank, Bradesco, Itau Unibanco, and Santander account for 43% of the Brazilian banking system, and their credit portfolio as of December 2010 was R$573 billion (US$345 billion).[10] The bank that provided us with the data (hereafter "The Bank") plays a significant role in the car loan market, having a market share of more than 15% in 2003, the first year of our data.

We obtained a random, yet balanced, sample of about 17,000 loan contracts covering the period from August 2003 to July 2005. Our data span an interval of the 24 months surrounding the implementation of the law. We chose this time frame in order to incorporate in the analysis the time needed by The Bank to better understand the law and adjust its lending practices to the new institutional setting. The symmetry of two equal periods of 12 months before and after the implementation of the law allows us to account for possible seasonal effects.

The dataset includes microlevel detailed information for each loan contract on contract terms, borrower's characteristics, and the cars against which the loans were made. The loan contract terms include credit spread (defined as the difference between the monthly interest rate on the loan and the federal rate fund), maturity (in months), down payment (borrower's out-of-pocket payment when buying the car), total financed (loan amount), and proportion financed (loan amount divided by car value).[11] The data also contain a rich set of borrower characteristics, including consumer leverage, income, risk, gender, job, residence, and marital status. We also know whether the borrower has been a client of the bank in the past and whether the loan is guaranteed by a third party. Finally, the data include information on the underlying car against which the loan was given. In particular, we know car model, year of manufacture, and whether a priority dealer made the sale. The Appendix provides detailed information on the definitions of the variables used here and their construction.

Table 1 displays descriptive statistics for the variables used in the analysis. Panel A of Table 1 presents summary statistics of borrower characteristics. The median borrower's monthly income is R$1,706 (US$605). There is a wide dispersion in borrowers' income, ranging from a 5th percentile of R$803 ($284.8) to a 95th percentile of R$6,181 ($2,191.9). The Bank's clients represent 24% of the borrowers in the sample, and 8% of the contracts have a third-party guarantor. The Bank classifies borrowers into three categories, "high risk," "medium risk," and "low risk," where 3% of borrowers are classified as "high risk." About two-thirds of the sample consists of males; 40% are single; and 45% are married. Homeowners represent 83% of the borrowers, and 13% of

[10] The public sector also plays a major role in the Brazilian banking system. For example, both the largest Brazilian bank, Banco do Brasil, and Caixa Econômica Federal, the fourth largest commercial bank, are controlled by the federal government.

[11] All loans in the data are amortized to equal payments through the life of the loan.

Table 1
Summary statistics

	Mean	5th percentile	Median	95th percentile	SD
Panel A: Borrower characteristics					
Income (R$)	3,065	803	1,706	6,181	23,986
Client of the bank	0.24	0.0	0.0	1.0	0.43
Guarantor	0.08	0.0	0.0	1.0	0.26
High risk	0.03	0.0	0.0	0.0	0.16
Medium risk	0.25	0.0	0.0	1.0	0.43
Low risk	0.73	0.0	1.0	1.0	0.45
Male	0.66	0.0	1.0	1.0	0.47
Single	0.40	0.0	0.0	1.0	0.49
Married	0.45	0.0	0.0	1.0	0.50
Homeowner	0.83	0.0	1.0	1.0	0.38
Lives with parents	0.13	0.0	0.0	1.0	0.33
Employee	0.59	0.0	1.0	1.0	0.49
Self-employed/entrepreneur	0.26	0.0	0.0	1.0	0.44
Retired/pensioner	0.12	0.0	0.0	1.0	0.32
Panel B: Contract characteristics					
Spread	1.10	0.20	1.08	2.20	0.66
Maturity	36.1	18.0	36.0	48.0	10.9
Down payment	6,903	1,487	4,461	16,249	35,269
Total financed (R$)	9,760	3,287	8,545	20,119	5,819
Car value(R$)	16,663	6,716	14,127	30,590	35,813
Consumer leverage	24.9	8.0	23.9	46.1	21.4
Panel C: Car characteristics					
New	0.21	0.0	0.0	1.0	0.41
Age	5.32	0.0	5.0	13.0	4.28
Dealer priority	0.88	0.0	1.0	1.0	0.33
Panel D: Loan outcome characteristics					
Late	0.08	0.0	0.0	1.0	0.27
Installment default	0.09	0.0	0.0	1.0	0.29
Default	0.08	0.0	0.0	1.0	0.26
Panel E: Macro controls					
Federal fund rate (monthly)	1.42%	1.24%	1.37%	1.67%	0.15%
Inflation rate (12 months)	8.92%	5.89%	7.60%	15.14%	2.90%
GDP growth (quarterly seasonally adjusted)	1.15%	−0.22%	1.26%	2.36%	0.84%

This table provides descriptive statistics for the variables used in the empirical analysis.

the borrowers live with their parents. Among the borrowers, 59% are employees of firms, compared with 26% classified as self-employed or entrepreneurs and 12% identified as retired or as pensioners.

As Panel B shows, the average spread is 1.10% per month with a standard deviation of 66 basis points per month. Loan maturity is around three years (36.1 months), with the 5th percentile being 18.0 months and the 95th percentile being 48.0 months. Down payments are sizable compared to car value. The average down payment is R$6,903 (US$2,448), while the amount financed averages R$9,760 (US$3,461). Borrowers finance, on average, 62.3% of car value. The mean consumer leverage—defined as the ratio of monthly loan installments to monthly income—is 24.9% and ranges from 8.0% (5th percentile) to 46.1% (95th percentile).

Panel C provides more information on the characteristics of the cars against which the loans are granted. There are two car characteristics. First, we define a dummy variable to indicate whether the car is new. Only 21% of the cars financed by The Bank are new. The mean car age is 5.32 years, and it ranges from new (5th percentile) to 13 years old (95th percentile). Second, The Bank classifies car dealers into two categories: priority and not priority. A dealer is considered a priority dealer if a low proportion of borrowers buying a car through the dealer default. In the sample, 88% of the cars were purchased from priority dealers.

Panel D reports summary statistics on three measures of loan outcomes. *Late* is a dummy equal to one if the borrower was late on a loan installment and is zero otherwise. *Installment Default* is a dummy variable equal to one if the borrower was late on two installments at the same time and is zero otherwise. Whenever a borrower has been late for over 90 days, the loan is considered to be in default. As Panel D demonstrates, the incidence of late payment and default happen in about 8% to 9% of the loans in our sample.

Finally, Panel E exemplifies the macroenvironment in Brazil during the period we study. As the table shows, average monthly federal fund rates were 1.42%, the inflation rate was 8.92% and ranged from 5.89% to 15.14%, and quarterly GDP growth was 1.15% on average.

4. Empirical Analysis

In this section, we analyze empirically the theoretical predictions laid out in Section 1 about the effect of the law on a battery of borrower characteristics, loan terms, and loan outcomes. Starting with a simple univariate analysis, Table 2 reports on the main variables of interest summary statistics that are calculated separately for the periods before and after enactment of the law.

Panel A reports summary statistics of borrower characteristics broken down by pre- and postlaw periods. The key characteristics that changed in a statistically significant manner in the postlaw period pertain to the borrowers' riskiness and employment status. According to Panel A, borrowers in the postlaw period were more likely to be high risk and to be self-employed or entrepreneurs than before the law was enacted. Similarly, Figure 1 displays the share of high-risk borrowers during the two years surrounding the enactment of the law.[12] As the figure illustrates, following the reform, the share of high-risk borrowers rose threefold from about 0.02 to 0.06.

Moreover, and as Panel B of Table 2 illustrates, average monthly credit spread declined from 1.18% to 1.02% after the law's enactment. Likewise, loan maturity increased from 34.6 to 37.7 months, down payments declined, and, as a result, the total amount financed (the size of the loan) increased, resulting in

[12] Quarter "0" is the quarter in which the law was enacted.

Table 2
Summary statistics: Before and after the law

	Before			After			
	Mean	Median	SD	Mean	Median	SD	Difference p-value
Panel A: Borrower characteristics							
Income	3,105	1,673	12,997	3,021	1,760	32,285	0.82
Client of the bank	0.24	0.0	0.49	0.24	0.0	0.43	0.79
Guarantor	0.08	0.0	0.27	0.07	0.0	0.25	0.00
High risk	0.02	0.0	0.13	0.04	0.0	0.19	0.00
Medium risk	0.25	0.0	0.43	0.24	0.0	0.43	0.26
Low risk	0.73	1.0	0.44	0.72	1.0	0.44	0.07
Male	0.66	1.0	0.47	0.66	1.0	0.48	0.54
Single	0.39	0.0	0.49	0.40	0.0	0.49	0.42
Married	0.45	0.0	0.50	0.44	0.0	0.50	0.46
Homeowner	0.83	1.0	0.38	0.83	1.0	0.38	0.74
Lives with parents	0.13	0.0	0.34	0.13	0.0	0.33	0.21
Employee	0.61	1.0	0.49	0.58	1.0	0.49	0.00
Retired/pensioner	0.12	0.0	0.32	0.11	0.0	0.31	0.02
Self-employed/entrepreneur	0.24	0.0	0.43	0.29	0.0	0.45	0.00
Panel B: Contract characteristics							
Spread	1.18	1.15	0.57	1.02	0.98	0.74	0.00
Maturity	34.6	36.0	10.1	37.7	36.0	11.2	0.00
Down payment	7,400	4,435	47,975	6,333	4,512	5,328	0.05
Total financed	9,115	7,983	5,407	10,501	9,127	6,176	0.00
Car value	16,514	13,381	15,530	16,834	15,284	8,392	0.56
Consumer leverage	24.5	23.0	18.4	26.5	24.2	24.4	0.00

This table reports descriptive statistics for the main variables used in the empirical analysis before and after enactment of the law.

loans with higher loan-to-value ratios and consumers with increased leverage. Figures 2 and 3 demonstrate the decline in credit spreads (Figure 2) and the prolonging of loan maturity (Figure 3) following the enactment of the law.

The evidence in Table 2 and Figures 1, 2, and 3 suggests that enactment of the law led to expansion of credit to riskier borrowers and to larger loans with lower spreads and longer maturities. We turn now to a multivariate regression analysis of the effects of the reform.

4.1 Repossession and the "democratization" of credit

We begin with a simple test of Prediction 1, which states that the reform enabled high-risk borrowers to obtain credit. Indeed, the summary statistics in Table 2 show that enactment of the law led to an increase in the fraction of borrowers who were classified as high risk (from 0.02 to 0.04, significant at the 1% level). The table also documents an increase in the share of borrowers who were self-employed or entrepreneurs, from 0.24 in the 12 months preceding the law to 0.29 in the 12 months after the law. As the process of reselling repossessed cars was expedited dramatically with the reform, the expected loss given default from a car loan also declined sharply. We argue that by increasing collateral values, the law relaxes constraints on the ability of borrowers to pledge their car as collateral. As a result, borrowers with a higher probability of default will be more likely to obtain an auto loan. That is, we expect the bank to expand

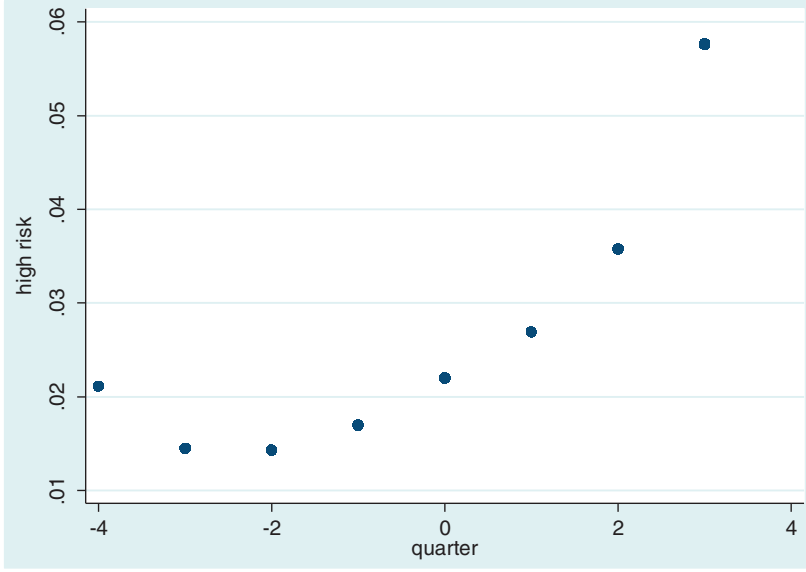

Figure 1
Share of high-risk borrowers before and after the reform.

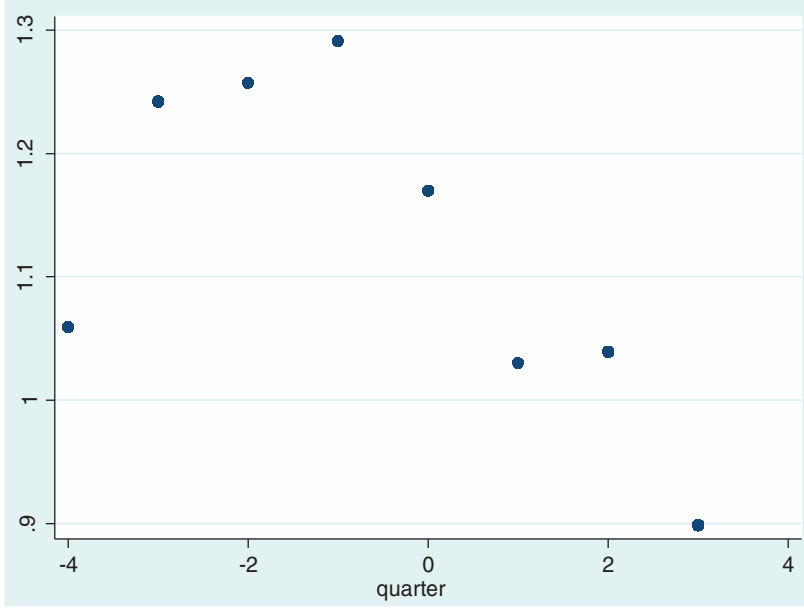

Figure 2
Credit spreads (in %) before and after the reform.

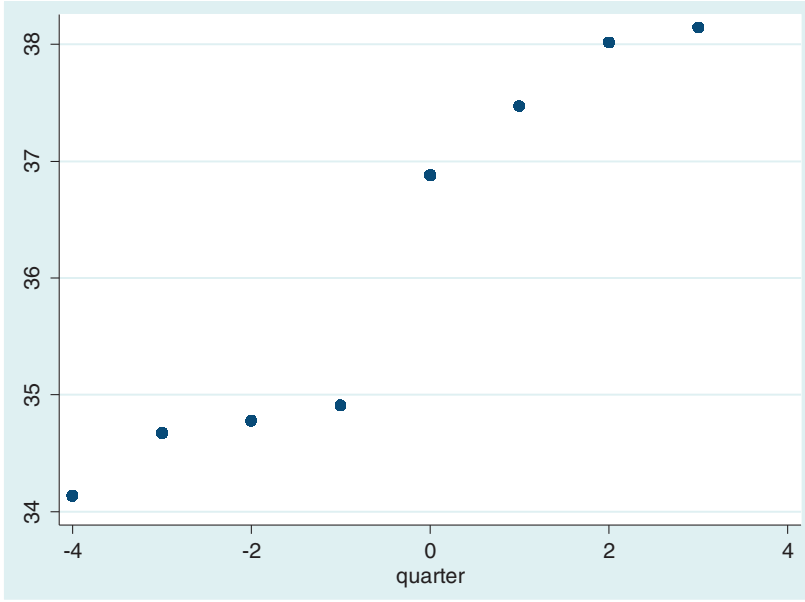

Figure 3
Loan maturity (in months) before and after the reform.

credit to riskier borrowers given that, in the event of default, the collateral is now more valuable. Ideally, we would have liked to document that applications for loans that were previously denied were eventually approved after the credit reform. Unfortunately, even though our microlevel data are very detailed, we do not have information on loan applications and hence must focus on loans that were actually granted. Instead, we test whether borrower characteristics changed after the reform.

Specifically, we test the effect of the law on the following measures of a borrower's risk: (1) income, (2) borrower's risk profile, and (3) whether the borrower is self-employed or is an entrepreneur and hence may lack a stable income. We estimate the following regression:

$$borrower\ risk_{i,t} = \alpha + \beta_1 \times law_t + \mathbf{T_{i,t}}\lambda + \mathbf{b_i}\psi + \mathbf{c_{i,t}}\theta + \mathbf{m_{i,t}}\xi + \mathbf{e_t}\gamma + \epsilon_{i,t}, \quad (1)$$

in which $law_{i,t}$ is a dummy variable indicating that the loan was initiated after the law was implemented; **T** is a vector of contract terms that includes spread, maturity, and down payment; **b** is a vector of borrower characteristics that includes gender, a dummy equal to one if the borrower has a guarantor, type of residence, marital status, and whether the borrower is a bank client; **c** is a vector of car characteristics and includes a dummy variable equal to one if the car is new, a dummy indicating whether the borrower took the loan from a priority dealership, and the year in which the car was made; **m** is a vector of car model fixed-effects; and **e** is a vector of macro controls that includes the federal fund

Table 3
The effect of the law on borrower risk

Dependent variable =	log(income)	High risk	Self-employed/entrepreneur
Law	–0.032**	0.014***	0.051***
	(0.015)	(0.004)	(0.013)
Contract terms	yes	yes	yes
Personal characteristics	yes	yes	yes
Car characteristics	yes	yes	yes
Car model fixed effects	yes	yes	yes
Macro controls	yes	yes	yes
Time trend	yes	yes	yes
State fixed effects	yes	yes	yes
Observations	17,349	17,349	17,349
Adjusted R^2	0.36	0.06	0.07

This table reports results from regressing borrower characteristics on *law*. We use three borrower characteristics as dependent variables: income, borrower risk, and whether the borrower is self-employed/entrepreneur. All regressions include an intercept. The regressions control for contract terms (spread, maturity, and down payment), borrower characteristics (income, borrower type of risk, gender, presence of a guarantor, type of job, type of residence, marital status, and whether the borrower is a client of The Bank), car characteristics (a dummy for new car, car age, and dealer priority), macro variables (inflation, federal fund rate, quarterly GDP growth, and time trend), car model fixed effects, and state fixed effects. Standard errors are calculated by clustering at both the state and month levels. Variables definitions are provided in the Appendix. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

rate, inflation, GDP growth, and a time trend.[13] The coefficient of one interest is β_1, which measures the effect of the law on contract characteristics. Table 3 presents the results.

The first column of Table 3 reports the effect of the law on the borrower's income. We define the dependent variable as the natural log of monthly income. Given that in Column (1) we estimate a semilog specification, the coefficient β_1 suggests that the monthly income of an average borrower is 3.2% lower after the reform—an effect that is robust to the inclusion of controls that pertain to contract terms, car and other personal characteristics, time-series-based macrocontrols, and a time trend. That is—consistent with Prediction 1 and Jappelli, Pagano, and Bianco (2005)—the reform succeeded in extending car loans to lower-income borrowers who were otherwise constrained in their ability to borrow, given low collateral values.

Next, we study the effect of the law on the risk profile of borrowers. Whereas our first measure of borrower's income is likely correlated with the risk of default, we now turn to a more direct measure of risk that is used by The Bank for credit analysis. We regress our measure for high-risk borrowers on the law dummy and the battery of control variables used before: contract terms, personal characteristics, macrocontrols, and a time trend. As the second column of Table 3 shows, $\beta_1 = 0.014$, indicating an increase in the proportion of high-risk borrowers among the population of borrowers after the reform. The economic magnitude of this effect is sizeable, representing an increase of

[13] Even though our results hold when we include year fixed effects, we employ a time trend in order to utilize the variation in the twenty-four months surrounding the enactment of the law. In contrast, when we include year fixed effects, we can identify only off of variation in the year 2004.

70.0% compared with the unconditional mean in the period before enactment of the law.

Finally, in the last column of the table we test whether the law has had an effect on the likelihood that a borrower is self-employed or an entrepreneur. We hypothesize that, given that The Bank can now put more weight on collateral in its credit allocation, it will have less need to rely on a stable source of income that is more typical for those employed by firms than for the self-employed. As Table 3 shows, and consistent with the evidence from the summary statistics in Table 2, we find that the reform had a significant effect on the likelihood that someone who is self-employed or an entrepreneur will be able to obtain a car loan from The Bank. The coefficient of the law dummy, $\beta_1 = 0.051$ (significant at the 1% level), represents an increase of 21.3% compared with the unconditional mean in the period before the reform.

The regressions reported in Table 3 show that after controlling for contract terms, car characteristics, and other borrower characteristics, such as gender and marital status, the law led to a change in borrower characteristics, such as income, risk, and self-employment. However, enhancement in collateral values is also likely to affect loan terms and the type of cars purchased by borrowers. Put differently, the effects of the law on borrower characteristics also had independent effects on loan terms, which in turn can affect borrower characteristics. The specification in Model (1) attempts to separate the indirect effects—for example, that of loan terms—from the direct effect of the law on the borrower's risk profile. However, given that some of the regressors are endogenous, the estimate of β_1 is potentially biased. This is what Angrist and Pischke (2009) call the "bad control problem," where the inclusion of endogenous control variables may result in biased estimates.[14]

One solution to this problem is to use variables that are measured before the determination of the variable of interest—as in a lagged variables model. However, this is impossible in the context of our paper, where contractual terms, borrower characteristics, and other outcomes are jointly determined. We try to address this problem by dropping most of the controls in Model (1) and focusing on a model that includes the law dummy and the clearly exogenous macrocontrols and time trend $\mathbf{e_t}$.

$$borrower\ risk_{i,t} = \alpha + \beta_1 \times law_t + \mathbf{e_t}\gamma + \epsilon_{\mathbf{i,t}}, \tag{2}$$

Table 4 presents the results. As the table shows, we obtain results that are similar qualitatively to those in Table 3. The coefficient of log income changes from −0.032 to −0.025 and is no longer significant, whereas both the high risk and self-employed coefficients are statistically significant at the 1% level. Moreover, whereas the high risk coefficient is identical to the one reported in Table 3 (0.014), the self-employment coefficient is now lower (0.039 compared

[14] Angrist and Pischke (2009, 64–66).

Table 4
The effect of the law on borrower risk (without micro controls)

Dependent variable =	log(income)	High risk	Self-employed/entrepreneur
Law	–0.025	0.014***	0.039***
	(0.025)	(0.004)	(0.014)
Macro controls	yes	yes	yes
Time trend	yes	yes	yes
Observations	17,349	17,349	17,349
Adjusted R^2	0.01	0.01	0.01

This table reports results from regressing borrower characteristics on *law*. We use three borrower characteristics as dependent variables: income, borrower risk, and whether the borrower is self-employed/entrepreneur. All regressions include an intercept, macro variables (inflation, federal fund rate, and quarterly GDP growth), and a linear time trend. Standard errors are calculated by clustering at both the state and month levels. Variables definitions are provided in the Appendix. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

with 0.051 in Table 3), representing an increase of 16.3% compared with the unconditional mean in the period before the reform.

4.1.1 The "democratization" of credit: Difference-in-differences. Our results so far rely on the assumption that, after controlling for macrovariables, changes in the law over time affect the outcomes of interest. That is, the variable *law* captures only the effects of the reform. However, other important polices that affect credit markets change over time and potentially coincide with our time-series measure of the reform. Although our analysis controls for time trend and for such macrovariables as the federal fund rate, inflation, and GDP growth, it is possible that unobserved contemporaneous shocks affect borrowers through channels other than the law.

To alleviate concerns about the validity of our identification strategy, we add a cross-sectional dimension to the analysis by augmenting the data on car loans with information on other personal loans. The personal loans made by The Bank are general-purpose loans that are not backed by collateral. The Bank has provided us a random sample of 15,326 personal loans that were made between August 2003 and July 2005. We append the personal loans sample to the 17,349 car loans to yield a dataset of 32,675 loans made by The Bank between August 2003 and July 2005.

Because the legal reform does not apply to personal loans, they should not be affected by implementation of the law. We can thus use the personal loans sample as our control group, while using the car loans sample as the treatment group. By using personal loans as a control group, we can pin down the effect of the reform on car loans. We implement a difference-in-differences specification using both types of loans and estimate the following equation:

$$borrower\ risk_{i,t} = \alpha + \beta_1 \times law_t + \beta_2 \times car_{i,t} + \beta_{12} \times law_t \times car_{i,t} + \mathbf{e_t}\gamma + \epsilon_{\mathbf{i,t}}, \quad (3)$$

in which all variables are defined as in previous specifications, and *car* is a dummy variable that equals one for car loans and is zero in the case of a personal loan. The difference-in-differences coefficient β_{12} measures the differential effect of the law on car loans. Table 5 presents the results.

Table 5
Borrower risk: Difference-in-differences

Dependent variable =	log(income)	High risk	Self-employed/entrepreneur
Law× car loan	−0.050***	0.012***	0.091***
	(0.015)	(0.004)	(0.009)
Car loan	−0.142***	−0.042***	0.062***
	(0.013)	(0.003)	(0.008)
Law	0.049***	0.008**	−0.031***
	(0.011)	(0.004)	(0.006)
Macro controls	yes	yes	yes
Time trend	yes	yes	yes
Observations	32,675	32,675	32,675
Adjusted R^2	0.03	0.01	0.05

This table reports results from estimating a difference-in-differences using both car and personal loan observations. We use three borrower characteristics as dependent variables: income, borrower risk, and whether the borrower is self-employed/entrepreneur. All regressions include an intercept, *law*, *car loan*, *law*×*car loan*, macro variables (inflation, federal fund rate, and quarterly GDP growth), and a linear time trend. Standard errors are calculated by clustering at both the state and month levels. Variables definitions are provided in the Appendix. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

As evident from the statistical significance of β_1, the first column shows that all borrowers—whether those who took out car loans or those who borrowed unsecured for general purposes—had on average higher income after the legal reform, capturing a trend of improvement in macroeconomic conditions in Brazil during the latter part of our sample. Likewise, the column shows that car loans (captured by β_2), which are secured by collateral, were taken out by borrowers with lower income compared with those who took out personal loans, which are unsecured. Finally, the difference-in-differences coefficient $\beta_{12} = -0.050$ (significant at the 1% level) is specific to car loans after the reform—suggesting that the effect of the reform has been to enhance the provision of credit to lower-income borrowers.

In the second column of Table 5 we use a high-risk dummy as our dependent variable. As the table shows, car loans borrowers are—on average—more likely to be riskier. This is consistent with the notion that risky borrowers are more likely to borrow on collateral.

We also find that during the latter part of the sample typical borrowers were more likely to be classified as being "high risk." Finally, as we found earlier, the difference-in-differences estimator β_{12} is significant both statistically and economically, indicating a robust differential effect for car loans. The positive coefficient ($\beta_{12} = 0.012$) indicates that the legal reform has enabled riskier borrowers to obtain car loans.

The last column of Table 5 uses the self-employment/entrepreneur dummy as the dependent variable. As Column (3) of the table demonstrates that, whereas over time self-employed borrowers were less likely to obtain credit, self-employed borrowers and entrepreneurs were more likely to obtain an auto loan after implementation of the law.[15]

[15] Although self-employed borrowers were about six percentage points more likely to obtain a car loan in general, the differential effect of β_{12} is 0.091 and is statistically significant at the 1% level.

Taken together, our results suggest that, after the reform, The Bank expanded financial services to higher-risk and self-employed borrowers and, in some circumstances, also to lower-income borrowers. The evidence shows that the improvement in banks' ability to foreclose and repossess collateral leads to broader access to finance. Our findings point to the importance of collateral in alleviating credit rationing and are consistent both with the predictions of Bester (1985, 1987) and Jappelli, Pagano, and Bianco (2005) and with the empirical results for Italian provinces presented in Jappelli, Pagano, and Bianco (2005). As far as we know, this paper is the first to provide evidence that the ability to repossess and resell collateral leads to the "democratization of credit"—as lower-income, riskier, and self-employed borrowers gain access to loans from The Bank.

4.2 The legal reform and loan terms

We now move to our second prediction: increases in collateral values that result from the legal reform will lead to larger debt capacity, longer debt maturity, and lower credit spreads for safe borrowers. Indeed, Panel B of Table 2 provides suggestive evidence that the law affected loan terms in a manner that is consistent with Prediction 2. Although the evidence in Table 2 shows that the law had an effect on loan terms, on average the reported statistics are not conditioned on borrower's risk. We first validate the results in Panel B of Table 2 in a regression model and then move to study the effect of the law on loan terms conditional on the borrower's risk. We conduct a multivariate analysis of the effect of the law on loan terms by estimating the following equation:

$$loan\ terms_{\mathrm{i,t}} = \alpha + \beta_1 \times law_{\mathrm{t}} + \mathbf{e_t}\gamma + \epsilon_{\mathbf{i,t}}, \tag{4}$$

in which $law_{i,t}$ is a dummy variable indicating that the loan was initiated after the law was implemented, and **e** is a vector of macrocontrols that includes the federal fund rate, inflation, GDP growth, and a time trend. The coefficient of interest is β_1, which measures the effect of the law on contract characteristics.

We follow the "leaner" specification of Regression (2) and Table 4 because of the "bad controls problem" discussed earlier. All of the results hold when we control for the battery of loan, personal, and car characteristics, but here we report only the estimates of the regressions without the endogenous controls.[16]

Panel A of Table 6 reports results from estimating the effect of the credit reform on spreads, maturity, loan size, and consumer leverage. As we discussed before, because debt contracts have several facets that are jointly determined, it is virtually impossible to estimate the simultaneous effect of the reform on each of these dimensions. Instead, we study each contractual term separately.[17]

[16] The results of the models with all the controls are available on request.

[17] This approach is similar to Benmelech, Garmaise, and Moskowitz (2005) and Qian and Strahan (2007).

Table 6
The effect of the law on loan contracts

Dependent variable =	Spread	Maturity	log(loan size)	Leverage
Law	–0.203***	2.432***	0.128***	1.806***
	(0.032)	(0.349)	(0.018)	(0.501)
Macro controls	yes	yes	yes	yes
Time trend	yes	yes	yes	yes
Observations	17,349	17,349	17,349	17,349
Adjusted R^2	0.04	0.02	0.01	0.01

This table reports results from regressing loan characteristics on *law*. We use four measures of loan characteristics: spread, loan maturity, loan size, and consumer leverage. All regressions include an intercept. The regressions control for macro variables (inflation, federal fund rate, and quarterly GDP growth), and a linear time trend.. Standard errors are calculated by clustering at both the state and month levels. Variables definitions are provided in the Appendix. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

As the first column of Table 6 shows, the reform significantly decreased credit spreads charged by The Bank. We find that after the reform, credit spreads on car loans declined by 20.3 (246) basis points per month (year), representing a decline of 17.2% compared with the unconditional mean spread.

Moreover, as the second column shows, the reform prolonged the maturity of the loans by 2.43 months (statistically significant at the 1% level), representing an increase of 7% relative to the unconditional average maturity before the law was enacted. These results are consistent with a recent A. T. Kearney report, which states that "… automotive credit has grown at consistent rates over the past years. Outstanding volumes have risen from R$30 Billion in 2003 to R$100 Billion in 2007. Average loan terms, which ranged from 24 to 36 months in the past, today are set, as a standard, at 60 months. More aggressive financial companies risk contracts of 72 or even up to 99 months."[18]

Column 3 shows that average loan size (defined as the natural log of the total amount financed) increased by 12.8%. Likewise, the last column of Table 6 reports the effect of the legal reform on consumer leverage. Leverage—defined as the ratio of loan installment to income—increases by 1.806 (7.4% of the unconditional mean before enactment of the law).

As Table 6 demonstrates, the reform led to improvements in contractual terms by prolonging loan maturity, reducing credit spreads, and increasing loan amounts. Our results are consistent with previous empirical studies on the effects of collateral values and legal protection on different contracts dimensions (Benmelech, Garmaise, and Moskowitz 2005; Qian and Strahan 2007; Benmelech and Bergman 2009).

Although the estimates in Table 6 show that average maturity has lengthened, it is unlikely that all contracts have increased by about two months; more likely, some contracts have increased substantially, whereas the maturity of others has

[18] www.atkearney.com/index.php/Our-expertise/financial-brazils-economic-risk-from-accentuated-growth-in-auto-loans.html

Table 7
Speed of repossession and loan maturity

Dependent variable =	Maturity (2 years or longer)	Maturity (3 years or longer)	Maturity (4 years or longer)
Law	0.025***	0.066***	0.101***
	(0.007)	(0.013)	(0.017)
Macro controls	yes	yes	yes
Time trend	yes	yes	yes
Observations	17,349	17,349	17,349
Adjusted R^2	0.01	0.01	0.02

This table reports results from regressing measures of loan maturity on *law*. We use three measures of loan maturity: a dummy variable that takes the value of one if maturity is 2 years or longer, 3 years or longer, and 4 years or longer. All regressions include an intercept, macro variables (inflation, federal fund rate, and quarterly GDP growth), and a linear time trend. Standard errors are calculated by clustering at both the state and month levels. Variables definitions are provided in the Appendix. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

not been affected. We analyze the effect of the law on loan maturity in more detail in Table 7. We run linear probability OLS regressions to study the effect of the law on the likelihood that loan maturity is (1) two years or more, (2) three years or more, and (3) four years or more. Panel A shows that the likelihood of longer-term loans with maturities exceeding two, three, and four years increased after enactment of the law. Thus, the law did not merely increase the maturity of the average loan but also led to the creation of loans that are one or two years longer.

4.2.1 Changing borrower characteristics and loan terms. In this section we conduct a more direct test of Prediction 2 by estimating the effects of the law on loan terms conditional on borrower characteristics. The evidence in Tables 3 and 4 clearly demonstrates that the enactment of the law enabled The Bank to grant loans to borrowers who would have been previously denied credit. In addition to improving loan terms by reducing spreads and increasing maturities and loan amounts, the law has led to the provision of credit to riskier borrowers, which in turn leads to higher spreads, shorter maturities, and smaller loan amounts. That is, the average effect of the law on contracts is masked by its effect on increasing the supply of credit to riskier borrowers.

Given that the reform led to an influx of riskier, low-income borrowers, we stratify the data on measures of risk and income to evaluate the law's effect on contracts separately for each group.[19]

Panel A of Table 8 reports results based on risk stratification. We split the sample into borrowers with a credit score of one (low risk) and those with the highest level of risk (score of three) and estimate separate regressions within each group. There are 12,624 individuals classified at a low risk, and 464 at a highest risk, of default.

[19] We verify that income, high risk, and self-employment are all indeed important determinants of actual default by estimating a default probability model. In unreported results we find that these three variables are all significant in predicting loan default.

Table 8
The effect of the law on loan contracts stratified by risk and income

Dependent variable =	Spread		Maturity		log(loan size)		Leverage	
	Risk		*Risk*		*Risk*		*Risk*	
	Low	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*
Panel A: Stratified by risk								
Law	−0.220***	−0.077	2.180***	2.265	0.134***	0.033	1.907***	−1.793
	(0.037)	(0.088)	(0.394)	(1.510)	(0.020)	(0.098)	(0.562)	(2.790)
Macro controls	yes	yes	yes	yes	yes	yes	yes	yes
Time trend	yes	yes	yes	yes	yes	yes	yes	yes
Observations	12,624	464	12,624	464	12,624	464	12,624	464
Adjusted R^2	0.03	0.04	0.02	0.02	0.01	0.02	0.01	0.01
Panel B: Stratified by income								
Law	−0.075	−0.270***	2.454***	2.08***	0.075***	0.121***	1.869	1.520*
	(0.049)	(0.044)	(0.477)	(0.704)	(0.024)	(0.028)	(1.494)	(0.805)
Macro controls	yes	yes	yes	yes	yes	yes	yes	yes
Time trend	yes	yes	yes	yes	yes	yes	yes	yes
Observations	4,365	4,301	4,365	4,301	4,365	4,301	4,365	4,301
Adjusted R^2	0.02	0.07	0.01	0.03	0.01	0.03	0.01	0.01

This table reports results from regressing loan characteristics on *law*. Panel A stratifies the sample into low risk (odd columns) and high risk (even columns). Panel B stratifies the sample into low income (odd columns) and high income (even columns). We use four measures of loan characteristics: spread, loan maturity, loan size, and consumer leverage. All regressions include an intercept, macro variables (inflation, federal fund rate, quarterly GDP growth), and a linear time trend. Standard errors are calculated by clustering at both the state and month levels. Variables definitions are provided in the Appendix. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

As the first two columns of Panel A show, and consistent with Prediction 2, the effect of the reform on credit spreads is higher for low-risk borrowers compared with high-risk individuals. In a sample of 12,624 loans to low-risk borrowers, the coefficient of β_1 is −0.220, representing a decrease of 18.6% relative to the mean (significant at the 1% level). In comparison, $\beta_1 = -0.077$ and is statistically insignificant in the high-risk sample. Likewise, loan maturity increased by 2.2 months, although there is no statistically significant effect of the law on loan maturity of risky borrowers. The next two columns show that although the law increased loan size by 13.4% for low-risk borrowers, it had no effect on loans to high-risk individuals. Finally, the law led to higher leverage ratios for risky borrowers but had no effect on risky borrowers.

We conduct similar analysis in Panel B, comparing the differential effect of the law on the first and fourth quartiles of income. Consistent with Prediction 2 and the evidence in Panel A, we find that for high-income borrowers β_1 is −0.270, representing a decrease of 22.9% relative to the mean (significant at the 1% level). In comparison, for low-income borrowers $\beta_1 = -0.075$ and is statistically insignificant. Similar results are obtained for loan size and leverage in which the effect is higher for high-income borrowers, whereas the effect of the law on the loan maturity of low-income borrowers is slightly higher than those of borrowers with high income.

4.3 Collateral and loan terms: Cross-sectional evidence

We add an additional cross-sectional dimension to the analysis by utilizing information on the age of the car underlying the loans.[20] Some asset types, such as cars, are subject to accelerated depreciation, in which they lose more of their value up-front. Indeed, in the United States the Internal Revenue Service allows accelerated depreciation for newer cars, in which a larger fraction of the asset value can be deducted in the first two years of the car's life. Although the legal reform applies to all auto loans, we expect loans on new cars to be affected more than those backed by older cars. Before the reform it took banks about two years to resell a repossessed car regardless of its age, but a newer car is expected to lose more of its collateral value earlier on, which should affect the terms of loans secured by new cars more than those secured by used ones.

We stratify the sample based on car age and estimate regressions similar to the specification in Equation (4). Panel A of Table 9 reports results based on a new/old car stratification, whereas Panel B stratifies loans backed by used cars along a five-year age threshold. Similar to Regression (4), we control for macrovariables and a time trend.

As the first two columns of Panel A show, the effect of the reform on credit spreads is higher for new cars compared with used cars. In a sample of 3,703 new auto loans, the coefficient of β_1 is -0.315, representing a decrease of 26.7% relative to the mean, and is significant at the 1% level. In comparison, $\beta_1 = -0.085$ and is statistically insignificant in a sample of 13,646 loans that are secured for used cars. We obtain similar results for each of the other dimensions of the contract.

The law prolonged loan maturity by 5.8 months for new cars, representing an increase of 17% compared with a more moderate increase of 2.4 months in loans secured for used cars. The next two columns show that the law increased loan size by roughly the same amount for both new and used car loans. Finally, the law led to higher leverage ratios for new cars compared with old cars (3.5% compared with 1.1%).

We further stratify the data on used cars in Panel B, using five years as our stratification threshold. There are 5,300 used cars that are five or fewer years old and 8,346 cars that are older than five years. Consistent with the findings in Panel A, we find that loans secured by used cars that are up to five years old have lower spreads, longer maturities, and bigger loans compared with loans secured for older cars. Taken together, the evidence presented in Table 9 is consistent with the importance of the legal reform for collateral values and

[20] We do not conduct a difference-in-differences analysis of loan terms because the terms of these car loans and the personal loans are very different and cannot be used for comparison. For example, the mean credit spread of a personal loan is 3.5% per month with (standard deviation = 1.18% per month), and the average maturity is 13.3 months.

Table 9
The effect of the law on loan contracts stratified by car age

Panel A: New versus used

Dependent variable =	Spread *Car*		Maturity *Car*		log(loan size) *Car*		Leverage *Car*	
	New	*Used*	*New*	*Used*	*New*	*Used*	*New*	*Used*
Law	−0.315***	−0.085	5.776***	2.390***	0.088***	0.0884***	3.521***	1.111***
	(0.038)	(0.032)	(0.770)	(0.355)	(0.028)	(0.010)	(1.688)	(0.455)
Macro controls	yes	yes	yes	yes	yes	yes	yes	yes
Time trend	yes	yes	yes	yes	yes	yes	yes	yes
Observations	3,703	13,646	3,703	13,646	3,703	13,646	3,703	13,646
Adjusted R^2	0.08	0.04	0.03	0.02	0.03	0.01	0.01	0.01

Panel B: Used cars only

Dependent variable =	Spread *Car*		Maturity *Car*		log(loan size) *Car*		Leverage *Car*	
	Up to 5 years	*More than 5 years*	*Up to 5 years*	*More than 5 years*	*Up to 5 years*	*More than 5 years*	*Up to 5 years*	*More than 5 years*
Law	−0.120**	−0.034	3.643***	1.471***	0.125***	0.041	0.617	1.366**
	(0.047)	(0.045)	(0.594)	(0.383)	(0.029)	(0.027)	(0.823)	(0.613)
Macro controls	yes	yes	yes	yes	yes	yes	yes	yes
Time trend	yes	yes	yes	yes	yes	yes	yes	yes
Observations	5,300	8,346	5,300	8,346	5,300	8,346	5,300	8,346
Adjusted R^2	0.12	0.04	0.03	0.01	0.03	0.01	0.01	0.01

This table reports results from regressing loan characteristics on *law*. Panel A stratifies the sample into new car (odd columns) and used car (even columns). Panel B stratifies the sample into used car up to five years (odd columns) and more than five years (even columns). We use four measures of loan characteristics: spread, loan maturity, loan size, and consumer leverage. All regressions include an intercept, macro variables (inflation, federal fund rate, and quarterly GDP growth), and a linear time trend. Standard errors are calculated by clustering at both the state and month levels. Variables definitions are provided in the Appendix. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

is unlikely to be driven by a mere improvement in the underlying economic environment.

4.4 The effect of the law on car characteristics

We now analyze the effect of the law on the type of car for which the loan is being secured. As shown in the previous section, the reform led to larger loans, lower spreads, and longer contracts and enabled additional lower-income, self-employed, and high-risk borrowers to obtain loans. We conjecture that the access to credit and the improvements in contractual terms may lead borrowers to choose newer, more expensive cars.

We report the results in Table 10, with the odd columns showing results from regressions that include car model fixed effects and the even columns presenting results without car model effects. All regressions control for macrovariables and a time trend.

The first column of Table 10 displays the results from a regression in which the dependent variable is the log of car value. As Column (1) demonstrates, the value of cars financed by The Bank after the reform increased by 6.3% (significant at the 1% level). The estimate in Column (1) is a *within-model* estimate because we control for car model fixed effects. When we do not

Table 10
The effect of the law on car characteristics

Dependent variable =	log(car value)	log(car value)	Car age	Car age	New car	New car
Law	0.063***	0.096***	−0.484***	−0.786***	0.051***	0.075***
	(0.013)	(0.019)	(0.124)	(0.199)	(0.019)	(0.027)
Car model fixed effects	yes	no	yes	no	yes	no
Macro controls	yes	yes	yes	yes	yes	yes
Time trend	yes	yes	yes	yes	yes	yes
Observations	17,349	17,349	17,349	17,349	17,349	17,349
Adjusted R^2	0.849	0.01	0.442	0.01	0.251	0.01

This table reports results from regressing car characteristics on *law*. We use log(car value), car age, and a dummy variable indicating whether the car is new as dependent variables. All regressions include an intercept, macro variables (inflation, federal fund rate, and quarterly GDP growth), and a linear time trend. The regressions in even columns do not control for car model fixed effects. Standard errors are calculated by clustering at both the state and month levels. Variables definitions are provided in the Appendix. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

difference out car model effects, the coefficient is larger (9.6%) because it captures not only within-model price variation but also cross-car model variation due to borrowers shifting to more expensive model types.

Likewise, Columns (3) and (4) show that the age of cars financed by The Bank declined by 0.484 and 0.786 years, respectively. Finally, we define a dummy variable that takes the value of one if the car is new and is zero otherwise, and estimate the probability that The Bank will finance a new car after the reform. Columns (5) and (6) show that a new car is between 5.1 and 7.5 percentage points more likely to be financed by The Bank—representing an increase of between 24.3% and 35.7% relative to the mean.

Our results suggest that the reform enabled consumers to buy newer, more expensive cars. Further, the improvement in car characteristics was obtained through better contractual terms—mostly by prolonging maturities. That is, the improvement in The Bank's ability to sell foreclosed cars led to better contracts that had an income effect on borrowers: their ability to borrow for longer terms and for lower spreads enabled them to buy newer, more expensive cars.

4.5 The effect of the law on delinquency and default

Finally, because the reform leads to expansion of credit to individuals who were previously denied credit, the deterioration of the borrower pool will increase the average default rate (Prediction 3). The results in Tables 3 and 4 show that the credit reform led to the "democratization of credit" in that lower-income borrowers and borrowers with a higher risk of default were more likely to obtain car loans after the law was passed. But what about the performance of these loans? A growing body of empirical evidence suggests that credit expansion leads to subsequent waves of default and repossession (Keys et al. 2010; Mian and Sufi 2009, 2010). Did the reform lead to more defaults?

We use three loan outcomes to capture the performance of loans: (1) late payment—a dummy variable that takes the value of one if the borrower was late on at least one payment even if it did not lead to a default, (2) installment default—a dummy variable that takes the value of one if the borrower defaulted

Table 11
The effect of the law on delinquency and default

Dependent variable =	Late payment	Installment default	Loan default
Law	0.014*	0.013	0.013*
	(0.008)	(0.008)	(0.007)
Macro controls	yes	yes	yes
Time trend	yes	yes	yes
Observations	17,349	17,349	17,349
Adjusted R^2	0.01	0.01	0.01

This table reports results from regressing loan outcomes on *law*. We use three measures of loan outcomes: late payment, installment default, and default. All regressions include an intercept, macro variables (inflation, federal fund rate, and quarterly GDP growth), and a linear time trend. Standard errors are calculated by clustering at both the state and month levels. Variables definitions are provided in the Appendix. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

on at least one installment, and (3) loan default—a dummy variable equal to one if the borrower was late for more than 90 days on at least one monthly installment.

We estimate the following equation using a linear probability model:

$$loan\ outcome_{i,t} = \alpha + \beta_1 \times law_{i,t} + \mathbf{e_t}\gamma + \epsilon_{\mathbf{i,t}} \quad (5)$$

in which the vector **e** is defined as before and the coefficient β_1 captures the effect of the law on the loan outcomes. Results are presented in Table 11.

The first column of the table reports the results from a linear probability regression in which the dependent variable is a *late payment* dummy variable. We find that the likelihood of a late payment increased after the reform. The effect of the law on the probability that the borrower will be late on at least one installment is fairly large—implying an increase of 17.5% relative to the mean. A similar (though not statistically significant) estimate is obtained when we use—as our dependent variable—a dummy variable that takes the value of one if the borrower has defaulted on at least one installment (Column 2). Likewise, a borrower is 16.3% more likely to be 90 days late on at least one installment—which, according to the Brazilian law, allows the bank to repossess the car—after the reform.

Taken together, the results in Table 11 demonstrate that auto loans signed after the implementation of the law performed worse than loans given in the 12 months before August 2004. Notably, once the law was passed, it affected all outstanding loans, including those that predated the law. We argue that the law enabled The Bank to expand credit to riskier borrowers because recovering collateral in the event of default became easier. Indeed, our previous results reported in Tables 3 and 4 are consistent with the notion that the reform was associated with the provision of credit to riskier borrowers.

5. Conclusion

We provide evidence from a 2004 credit reform in Brazil that simplified the selling of repossessed cars used as collateral for auto loans. Our evidence

suggests that the legal change has brought about a "democratization of credit," enabling riskier, lower-income borrowers to obtain loans and purchase newer, more expensive cars. The reform has led to larger loans with lower spreads, longer maturities, and higher leverage. In sum, this paper provides evidence on the consequences of a credit reform, highlighting the crucial role that collateral plays in alleviating credit rationing and affecting financial contracts.

The evidence in this paper shows that the ability to resell collateral enables banks to expand credit, mitigates financial shortfalls, and enhances the ability of borrowers to purchase newer, more expensive cars. Although we study the effect of a credit reform in Brazil using comprehensive data from one bank, our results propose a broader link, not confined only to Brazil or to the bank that provided us the data. The ability to repossess and resell collateral facilitates credit provision, in particular to borrowers who would be otherwise left out of credit markets.

Appendix: Variable description and construction

For reference, the following is a list of the variables used, their sources, and a brief description of how each is constructed.

(1) *Spread:* The difference between the monthly interest rate paid by the borrower and the federal fund rate (in percentage points).
(2) *Maturity:* Loan maturity (in months).
(3) *Down payment:* The amount paid by the buyer that was not financed (in R$).
(4) *Loan size:* The total amount financed by The Bank (in R$).
(5) *Law:* A dummy variable that takes the value of one if the loan was initiated after the law was implemented and is zero otherwise.
(6) *Consumer leverage:* The ratio of monthly loan installment to monthly borrower income.
(7) *Income:* The borrower's (estimated) monthly income calculated by The Bank (in R$).
(8) *Client dummy:* A dummy variable that takes the value of one if the borrower is a client of The Bank and is zero otherwise.
(9) *High risk dummy:* A dummy variable that takes the value of one if the borrower is classified as a high risk and is zero otherwise.
(10) *Guarantor dummy:* A dummy variable that takes the value of one if the loan has a guarantor and is zero otherwise.
(11) *Gender dummy:* A dummy variable that takes the value of one if the borrower is a male and zero is otherwise.
(12) *Type of job:* A five-category variable: employee, retired/pensioner, self-employed, entrepreneur, and other.
(13) *Type of residence:* A four-category variable: homeowner, lives with parents, renter, and other.
(14) *Marital status:* A five-category variable: single, married, divorced, widower, and other.
(15) *New car:* A dummy variable that takes the value of one if the car is new and is zero otherwise.
(16) *Car value:* Car value (in R$).
(17) *Model:* Car model.

(18) *Car age:* The difference (in years) between the date that the loan was signed and the date that the car was manufactured.

(19) *Dealer priority dummy:* A dummy variable that takes the value of one if the consumer bought the car from a priority dealer and is zero otherwise.

(20) *Federal fund rate:* The federal fund interest rate.

(21) *Inflation:* The inflation rate over the last twelve months.

(22) *GDP growth:* Quarterly GDP growth.

(23) *Late:* A dummy variable that takes the value of one if the borrower was late on at least one installment and is zero otherwise.

(24) *Installment default:* A dummy variable that takes the value of one if the borrower was late on at least two installments at the same time and is zero otherwise.

(25) *Default:* A dummy variable that takes the value of one if the borrower was at least ninety days late, and zero otherwise. (This the criteria used by the Central Bank.)

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