INTERNET APPENDIX: THE VALUE OF A GOOD CREDIT REPUTATION: EVIDENCE FROM CREDIT CARD RENEGOTIATIONS

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APPENDIX B. SUPPLEMENTARY ONLINE APPENDIX

B.1. **Other potential discontinuity margins.** The criteria for selection into the renegotiation offer sample offers three additional margins that are suitable candidates for discontinuities aside from the 50,000 pesos cutoff: (i) borrowers who as of January 2010 are above and below the 30 days late threshold, (ii) borrowers who have tenures at The Store above and below six months, and (iii) borrowers around the threshold number of renegotiations in the past years. The data suggests that the identification assumption for a regression discontinuity analysis, that is, that the distribution is continuous at the threshold, can be rejected for the first and third margins. In particular, the number of borrowers who have more than the maximum number of renegotiations in the last one or three years is substantially lower than the number that have less than the maximum. Further, the histogram of borrowers by days late (not presented in this paper) shows a large mass of borrowers immediately before 30 days. Officers at The Store relate this pattern to the fact that many borrowers that are late by less than 30 days would repay their debt precisely before 30 days to avoid being in arrears one full billing cycle.

The six-month minimum tenure at The Store offers some potential for a discontinuity analysis. However, borrowers who as of January 2010 have tenures with The Store of six or less months eventually cross the 6 month threshold and become eligible for the renegotiation campaign in subsequent months. Although the identification assumption may hold at this threshold, this fact greatly reduces statistical power.

B.2. **Bias due to differential access to new credit at The Store.** The outcome variable measures payments net of new credit as a fraction of the initial balance. One potential problem with this measure is that the dataset is right truncated at 20 months. Therefore, it may be the case that borrowers whose balance as of January 2010 is below the cutoff assume relatively more new credit in the final months of the sample, and their repayment of this new credit does not show up in the data. This would result in an upward bias in the measure of repayment of the initial outstanding balance.

I investigate this potential bias by looking at the cumulative value of new credit as a fraction of the initial outstanding balance, from months 8 to 20. If there were a differential access to credit before these months, a repayment time of at least 12 months would ensure the bias is minimized. Figure B.2 shows a plot of this variable, averaged in bins of 10,000 pesos, and the fitted values and standard errors of the fuzzy RD regression described in the main text. There is no discontinuity at the cutoff in the value of new credit in later months, which implies that at least by month 8, when there are 12 months left to observe repayment, borrowers above and below the cutoff have the same relative access to credit within The Store. This evidence reduces the probability that the results are biased.

B.3. **Placebo test for discontinuities .** I investigate whether the fuzzy RD framework generates discontinuities in other points of the distribution of outstanding balances as of January 2010, in particular for outstanding balance close to the 50,000 pesos cutoff. Results are shown in Figure B.3. No discontinuity is significant at the 10% level on any of these placebo cutoffs.

B.4. **External validity of the results.** I assess the external validity of the results in two steps. First, I test whether borrowers who renegotiate before write off because of the campaign (compliers) are observably different from borrowers in the renegotiation offer sample following the methodology found in Section 4.4.4 of Angrist and Pischke (2008). Intuitively, the idea is to test whether compliers are more or less likely than an average borrower from the renegotiation offer sample to have a value of a pre-determined variable that is above the sample median. Column 3 of Table B.3 shows that as of January 2010 compliers are almost as likely as borrowers in the renegotiation offer sample whose balance is within 10,000 pesos of the campaign cutoff to be late by more than 97% of their balance, to be in arrears by more than 87 days, to have a credit score that is above 472, to be female, and to be older than 37 years old. Compliers are relatively less likely to have tenures at The Store that are longer than 49 months, and to have a monthly income that is above 150,000 pesos (U$ 500), but this relative

likelihood is in both cases no lower than 0.75. Based on this analysis, compliers seem to be slightly poorer and to have had a shorter tenure at The Store, but look very much like other borrowers in the renegotiation offer sample in all the other dimensions.

A second point is how the findings relate to a more general population of borrowers. First, the RD design identifies the effect of the renegotiation before write off on borrowers whose value of the running variable, the balance as of January 2010, is relatively close to the cutoff. The value of reputation presumably varies with this balance. For example, borrowers with higher balances could be those who need to borrow more, and who would therefore value access to credit relatively more. Second, the value of a good credit reputation is presumably lower for borrowers who are in default. This would suggest that my estimate provides a lower bound for the population value. Third, it is likely that a clean credit record becomes more valuable for borrowers who plan on borrowing in the future, for example, those who plan on buying a house. This is consistent with anecdotal evidence in popular websites that call for borrowers to refrain from obtaining new credit cards in the year before they plan to apply for a mortgage. This would suggest that the above estimates are an upper bound for a more general class of borrowers.

B.5. **Robustness of RD specification.** In order to assess if the specification choices of the degree of the polynomial and length of the amount interval materially affect the results, I present in Table B.1 the fuzzy RD coefficient estimates of β for npv, $default(3)$ and $default(12)$. I also show the first stage $renegotiated$ for six months after selection for a number of different specification choices. The last rows present a local linear estimation in the spirit of Imbens and Lemieux (2008).[35] The results suggest that the main results hold irrespective of the particular choice of specification.

B.6. **The willingness to pay for a good reputation and time since default.** Table (B.2) shows the results of running the fuzzy RD analysis for three subsamples defined by each tercile of the distribution of days late as of January 2010. These

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[35]The optimal bandwitdh selection algorithm produces a bandwidth of the order of 5 pesos equal to roughly 1 cent. I show that results are robust to a wide range of functional forms and bandwidths.

regressions are run local linear polynomials. The estimated willingness to pay for a good credit reputation is positive in all cases. However, it is significant only for borrowers who are in the mid tercile of days late. It also is the highest in magnitude when considered as a fraction of the constant for the mid tercile sample of borrowers. Thus, the measured willingness to pay is lower for borrowers who have just defaulted, increases for borrowers in mid-range of default, and decreases again for borrowers near write off.

These results can be rationalized in a manner consistent with the reputational story in the following way. First, a concern for reputation gives borrowers an incentive to repay their debt. Thus, the average value of a good credit reputation should be lower for the sample of borrowers who are late by more days. In other words, the sample of borrowers who are observed to be late by more days will have, on average, a lower willingness to pay for a good credit reputation. The renegotiation that lowers their monthly installment may simply not be enough to induce them to repay. This suggests a negative relationship between the estimated willingness to pay and the number of days late.

However, because late installments accumulate over time, the payment due also increases with the time since default. Instead of paying a renegotiation, borrowers who have just defaulted may improve their reputation by simply paying their missed installment. Thus, the estimated willingness to pay for a good credit reputation is lower for borrowers who have just defaulted. These borrowers may obtain a clean credit record for a longer period by simply paying all their installments, which is on average cheaper than paying the renegotiation.

B.7. **Cross sectional variation of the willingness to pay for a good credit reputation.** I study whether the willingness to pay for a good credit reputation varies with predetermined characteristics. In particular, I explore whether borrowers in the renegotiation offer sample whose value of each of a list of predetermined variables is higher than the median of each variable are willing to pay a different fraction of

their balance for a good credit reputation. I report results for the outcome variable calculated using my preferred yearly discount rate of 48% per month.

I run separate regressions for the subsamples of borrowers whose values of the outcome are higher and lower than the sample median. For example, let $D = 1\,(age > age_{median})$, a dummy that equals 1 if the borrower is older than the sample median age. Then, I run the first stage regression (1) separately for the subsamples with $D = 0$ and $D = 1$, and in each case I report the coefficient π_D. I also run the 2SLS estimation with equation (5) as the second stage and present the coefficient β_D. In order to verify whether the coefficients π and β are statistically different in both subsamples, I interact equation (5) with a dummy that equals one if the variable is higher than the sample median and run a pooled regression that includes both subsamples with $D = 0$ and $D = 1$. The regression model is

$$(7) \qquad npv = \alpha + \beta renegotiation + \gamma renegotiation \times D + \epsilon.$$

As in the fuzzy RD setting, I use the variable *above* (conditional on a flexible polynomial of the balance as of January 2010) to instrument for *renegotiation*. In the same spirit, I allow the subsample of borrowers with $D = 1$ to have a different value of the discontinuity at the cutoff (π_D) and functional relationship between the January 2010 balance and the *renegotiation* variable. In this case, the reduced form equation is

$$npv = \alpha + \alpha_1 D + \beta \pi above + \gamma \pi_D treated \times D$$

$$+ \tilde{f}\,(amount - 50,000) + \tilde{f}_D\,([amount - 50,000] \times D) + \chi.$$

The statistical significance of γ can be used to assess whether borrowers in both subsamples are willing to pay different fractions of their initial balance to have a good credit reputation. I also present the results for an "expanded" first stage regression that includes the possibility that the discontinuity in the fraction of renegotiations and the

polynomials used to estimate it differ for borrowers in the different subsamples,

$$renegotiation = \omega + \omega_1 D + \pi above + \pi_D treated \times D+$$

$$+ f\left(amount - 50,000\right) + f_D\left(\left[amount - 50,000\right] \times D\right) + \eta.$$

Similarly, the statistical significance of π_D can be used to infer whether the phone campaign affects the fraction of renegotiations differentially for both subsamples.

Table B.4 shows that the fraction of borrowers who renegotiate is significantly higher for borrowers whose tenure is shorter than 58 months, for borrowers whose fraction of the balance that is late is above 47%, and for borrowers whose monthly income is less than 201,000 pesos. Borrowers above and below median age, internal credit score, and a dummy for female borrowers do not exhibit a significant difference in the fraction of renegotiations. The results for the fraction of the balance that is late should be taken with extra caution do to the high correlation of this variable with the *treated* instrument (e.g., from visual inspection of Figure 3).

Borrowers who are older, who have been clients of The Store for a longer period, who have a higher internal credit score, who are male, who are late by a larger fraction of their balance, and who earn a higher monthly income seem to be willing to pay more for a good credit reputation. However, the results are only significantly different for the internal credit score, gender and monthly income.

Some of these results are consistent with models of life cycle reputation acquisition such as Diamond (1989). For example, older borrowers are willing to pay more to restore their good credit reputation because they may have less time left to do so by paying their normal debts on time. Borrowers with longer tenures and higher internal credit scores presumably value their good credit reputation relatively more for similar reasons. Further, it is likely that in Chile most household heads are males, who may be relatively more interested in obtaining a good credit reputation in order to borrow for a house in the future. Finally, borrowers who are late by a larger fraction of their balance are those who would most benefit from a renegotiation that reduces the price of a good credit reputation.

Nevertheless, these results must be taken with caution: since the variable used to sort the subsamples is not randomly assigned, any difference in the estimated coefficients may not be interpreted causally. For example, age may be correlated with other variables, such as income and education so that the differences in repayment may be rather driven by these variables.

B.8. **Additional Tables and Figures.**

TABLE B.1. Robustness of fuzzy RD specification

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Interval	Deg.	Obs	$renegotiation$	npv	$default\,(3)$	$default\,(12)$
$[0, 500k]$	6	82,188	0.1291***	0.3040***	-0.2988***	0.2593***
$[10k, 400k]$	6	71,699	0.1217***	0.3364***	-0.4404***	0.1153
$[20k, 300k]$	6	57,107	0.1095***	0.2317*	-0.5859***	-0.0286
$[20k, 80k]$	2	21,371	0.1102***	0.2974*	-0.6606***	-0.0225
$[10k, 100k]$	Linear	33,023	0.1186***	0.2499*	-0.4369***	0.1400*
$[10k, 80k]$	Linear	30,043	0.1090***	0.2851*	-0.4820***	0.1221

This table shows that the particular choice of the degree of the fuzzy RD polynomial and the outstanding balance interval used to select the sample do not have a material effect on the main results of the paper. The table shows the fuzzy RD regression coefficients β, where the outcomes are $renegotiation$ six months after selection into the campaign , npv, $default\,(3)$ and $default\,(12)$, on $above$ and a polynomial of varying degree. "Linear" represents a local linear approximation. The amount owed as of January 2010 varies in column 1 (Interval), while the degree of the polynomial varies in column 2 (Deg.). Standard errors used to assess significance (not shown) are clustered at the "comuna" level. *, ** and *** represent significance at the 10%, 5% and 1% respectively.

TABLE B.2. Subsample analysis by days since default

	(1)	(2)	(3)
Outcome		$npv\,(48)$	
Days late as of Jan 2010	30-57	62-118	123-179
$renegotiation$	0.2200	0.2198**	0.0526
	(0.212)	(0.106)	(0.169)
$constant$	0.5374***	0.4001***	0.3179***
	(0.029)	(0.020)	(0.021)
R^2	0.008	0.033	0.053

This table shows how the estimated willingness to pay for a good credit reputation varies across the number of days late. The table shows the fuzzy RD estimates, implemented with a 2SLS procedure, where

$$renegotiation = \omega + \pi treated + f\,(amount - 50000) + \eta,$$

is the first stage and

$$npv = \alpha + \beta renegotiation + \epsilon,$$

is the second stage for three different sub-samples, which are split into terciles of the number of days late as of January 2010. The table shows the coefficient β where the outcome is npv, the discounted sum of payments for 20 months after January 2010 as a fraction of the initial balance, discounted with a 48% yearly rate. The instrumented variable, $renegotiation$, is a dummy that equals 1 if a borrower renegotiates within six months after January 2010, and $f\,(amount - 50000)$ is a local linear polynomial of the January 2010 balance. The sample corresponds to borrowers in the renegotiation offer sample, as defined above, whose outstanding balance as of January 2010 is between 10,000 and 200,000 thousand pesos (N=51,622). *, ** and *** represent significance at the 10%, 5%, and 1%, respectively. Standard errors are clustered at the "comuna" level (332 comunas), a Chilean geographical division similar to a U.S. county.

TABLE B.3. Likelihood of distribution of characteristics of compliers relative to renegotiation offer sample

Variable:	(1) First stage $\pi(6)$	(2) Median	(3) Relative Likelihood
Fraction late	0.123	0.969	1.021
Days late	0.128	87.0	1.066
Internal credit score	0.126	472.0	1.046
Age (yrs)	0.116	37.0	0.964
Tenure (months)	0.093	49.0	0.776
Income	0.096	150,000	0.797
Female	0.130	1.000	1.076

This table is based on Angrist and Pischke (2008), Section 4.4.4. For each listed variable, the table reports whether compliers of the *treated* instrument (as defined above) are more likely to have a value of that variable that is higher than its median. Compliers are not identifiable from the data, and are defined as those borrowers in the renegotiation offer sample who renegotiate before write off because their balance as of January 2010 is higher than 50,000 pesos. The size of the group of compliers is the unrestricted first stage coefficient shown on Table 2, approximately 0.1204 of the renegotiation offer sample right above the cutoff (for renegotiations that occur within 6 months). Column (1) shows the first stage regression coefficient $\pi(6)$ of regression

$$renegotiation\,(6) = \alpha\,(6) + \pi\,(6)\,treated + f\,(amount - 50000) + \eta,$$

for renegotiations that occur within 6 months after January 2010, restricting the sample to borrowers whose value of the variable is higher than the median. Column (2) shows the median of the variable for borrowers whose balance as of January 2010 is within 10,000 pesos (US\$20) of the cutoff (40,000 pesos to 60,000 pesos). Column (3) shows whether compliers of the *treated* instrument are more likely (a value greater than 1 means more likely) to have a value of the variable that is higher than the median. This is calculated as the first stage coefficient of the restricted sample (column (1)) divided by the unrestricted first stage, 0.1204.

TABLE B.4. Heterogeneity of results in the cross section

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	Age	Tenure	Credit score	Female*	Fraction late	Income
Median	40	58	463	1.0	0.4741	201,000
Outcome variable: *renegotiation*						
Separate regressions:						
$above_{D=0}$	0.1200***	0.1444***	0.1093***	0.1073***	0.0466**	0.1319***
	(0.0087)	(0.0093)	(0.0095)	(0.0099)	(0.0227)	(0.0087)
$above_{D=1}$	0.1207***	0.0890***	0.1274***	0.1295***	0.1211***	0.0980***
	(0.0103)	(0.0094)	(0.0093)	(0.0090)	(0.0072)	(0.0102)
Pooled regressions:						
$above \times D$	0.0007	-0.0554***	0.0181	0.0223	0.0745***	-0.0339**
	(0.0128)	(0.0131)	(0.0140)	(0.0140)	(0.0213)	(0.0135)
Outcome variable: *npv*						
Separate regressions:						
$renegotiation_{D=0}$	0.1600	0.1810	0.0839	0.6084***	-2.0526	0.1238
	(0.1638)	(0.1305)	(0.1560)	(0.2316)	(1.9295)	(0.1333)
$renegotiation_{D=1}$	0.4816**	0.5044*	0.4858***	0.1064	0.3467***	0.6905**
	(0.1981)	(0.2795)	(0.1811)	(0.1480)	(0.1309)	(0.2883)
Pooled regressions:						
$renegotiation \times D$	0.3216	0.3233	0.4019*	-0.5020**	2.3993	0.5667*
	(0.2549)	(0.3130)	(0.2229)	(0.2299)	(1.9695)	(0.2945)

This table shows the estimated π and β coefficients of the fuzzy RD estimation procedure as defined above, run separately for subsamples of borrowers in the renegotiation offer sample whose value of each variable in the table is higher than the sample median. Let $D = 1\,(variable > median)$. The table also presents the interaction coefficients of $treated \times D$ and $renegotiation \times D$ of a regression ran on the full sample,

$$npv = \alpha + \beta renegotiation + \gamma renegotiation \times D + \epsilon,$$

where *above* and *above* $\times D$ are used to instrument for *renegotiation* and *renegotiation* $\times D$. The flexible polynomial $f\,(amount - 50,000)$ is also allowed to vary for borrowers with $D = 1$. These interaction coefficients show whether the coefficients estimated from the separate regressions are statistically different. *, ** and *** represent significance at the 10%, 5%, and 1%, respectively. Standard errors are clustered at the "comuna" level (332 comunas), a Chilean geographical division similar to a U.S. county.

FIGURE B.1. Fraction of borrowers who renegotiate after write off
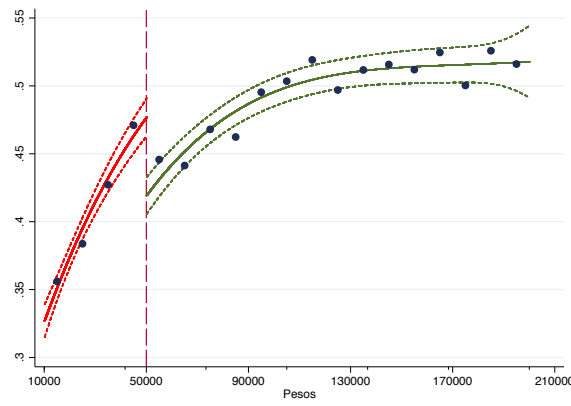
The figure shows the average fraction of borrowers in the renegotiation offer sample (as defined above) who renegotiate their loans after write off, between one and six months after January 2010, in bins of 10,000 Chilean pesos (USD20), and the fitted values and 90% confidence intervals from the regression model,

$$writeoff = \alpha_0 + \pi above + f(amount - 50000) + \epsilon,$$

where the outcome variable $writeoff$ is an indicator that equals 1 if the borrower's debt is written off the loan within six months after selection into the renegotiation offer sample, on $above$, a variable that equals 1 if the borrower owes more than 50,000 pesos as of Jan 2010 and 0 if she owes less, and $f(amount - 50000)$, a 4th degree polynomial of the outstanding balance at The Store as of January 2010. The dashed vertical line represents the 50,000 pesos campaign cutoff. Standard errors are clustered at the "comuna" level (332 comunas), a Chilean geographical division similar to a U.S. county.

FIGURE B.2. Cumulative value of new credit in The Store as a fraction of initial balance for 8 to 20 months after January 2010
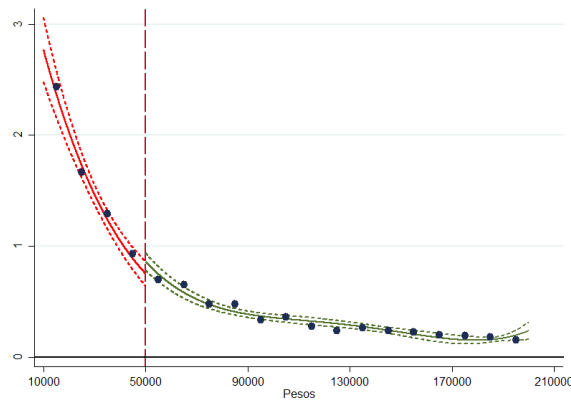
This figure shows that there is no discontinuity on the cumulative value of new credit at The Store as a fraction of initial balance at the phone campaign cutoff, which, if present, would bias the npv measure. The figure shows the average of $valuenewcredit8 - 20$, the discounted sum of the value of new credit, including new products bought on credit and cash advances taken by the borrower, between months 8 and 20, divided the outstanding balance as of January 2010 for borrowers in the renegotiation offer sample, in bins of 10,000 Chilean pesos (USD20), and the fitted values and 90% confidence intervals in the fuzzy RD regression model,

$$valuenewcredit8 - 20 = \alpha_0 + \gamma above + f(amount - 50000) + \epsilon,$$

where $valuenewcredit8 - 20$ is regressed on $above$, a variable that equals 1 if the borrower owes more than 50,000 pesos as of Jan 2010 and 0 if she owes less, and $f(amount - 50000)$, a 4th degree polynomial of the outstanding balance at The Store as of January 2010. The dashed vertical line represents the 50,000 pesos campaign cutoff. Standard errors are clustered at the "comuna" level (332 comunas), a Chilean geographical division similar to a U.S. county.

FIGURE B.3. Tests for discontinuities in *npv* at other balance cutoffs
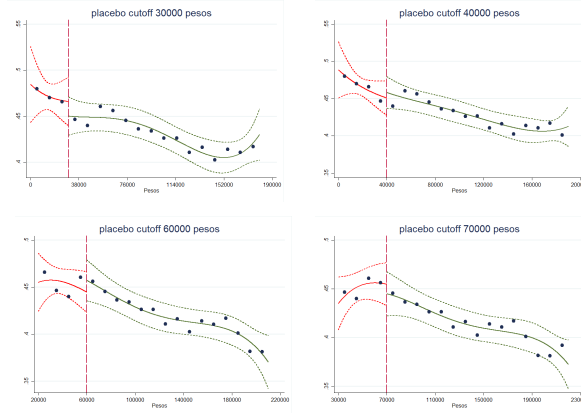
These figures show four plots for the average *npv*, as defined before, grouped in bins of 10,000 pesos (USD20) of the balance at The Store on January 2010, and the fitted values and a 90% confidence interval of the regression model in equation (1),

$$npv = \alpha_0 + \beta above + f\left(amount - 50000\right) + \epsilon$$

of each of these variables as outcomes, on *above*, a variable that equals 1 if the borrower owed more than 30,000, 40,000, 60,000 and 70,000 pesos as of January 2010, respectively, and a 4th degree polynomial for the amount owed as of January 2010. Standard errors are clustered at the "comuna" level (332 comunas).