INFORMATION SHARING REGIMES AND FINANCIAL ACCESS*

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Abstract

How does the availability of information shape lenders' decisions to provide access to credit card debt? This paper analyzes a setting in which bank card issuers operate in a public information regime while nonbank issuers report only defaults. Nonbank issuers appear to engage in learning by lending; they offer low initial limits to a broad set of borrowers, increasing limits for and maintaining private information about those who perform and cancelling cards of those who do not. Evidence from a joint venture between a bank and a nonbank issuer indicates that lenders compete for creditworthy borrowers when information about them is revealed. The incentives to engage in learning by lending are diminished when information about borrowers is widely available, reducing the extent to which opaque borrowers are able to obtain access to credit.

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Abstract

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I. Introduction

How does the availability of information shape lenders' decisions to provide access to credit? Lenders share information about borrowers through credit bureaus and registries, and the terms on which they do so vary widely across countries and across types of lenders. In some settings, lenders share both positive and negative information, so that the full credit history of a borrower is observable to any lender. In others, lenders share only negative information, so that a borrower who is current on her obligations cannot be distinguished from a borrower who has no credit. Reforms that expand information sharing are generally expected to promote competition and to improve access to credit.[1] This paper presents evidence that they involve a tradeoff. When information about borrowers is widely available, lenders have less incentive to learn which borrowers are creditworthy, and some of these borrowers go unserved.

The tradeoff arises because lenders can produce information about creditworthiness by lending. In the credit card market, a lender that is uncertain about which applicants will repay can issue cards with low limits to a wide range of applicants, increase limits for cardholders who make required payments, and reduce limits and cancel the cards of those who do not. The returns to this kind of activity are likely to be higher when serving borrowers whose creditworthiness is not obvious. A lender that can keep the positive information it learns private can absorb losses on nonperforming borrowers with rents it earns over time on performing borrowers whose credit histories are not observable to other capital providers. A lender that cannot keep positive information private does not have this incentive, because other lenders can observe which of its cardholders perform and compete away the rents. Such a lender instead has an incentive to screen extensively before issuance and to avoid borrowers who are not easy to evaluate.

[1] The revised Payment Services Directive in the European Union and Section 1033 of the Dodd-Frank Act in the United States provide two recent examples. Each expands the range of consumer financial information that can be shared across financial services providers.

The paper analyzes these incentives in the Chilean credit card market, where there is no standardized credit score comparable to FICO and bank and nonbank issuers operate under distinct information regimes. Banks report positive and negative information about their cardholders to the bank regulator, and any bank can observe the full credit histories of all bank cardholders. In contrast, nonbank issuers report only negative information to a privately owned credit bureau, so performing nonbank accounts are observable only to their issuer. In other respects, the two kinds of issuers are similar. Nonbank issuers are associated with retailers, and the cards a nonbank issues can be used outside the retailer's stores. Bank and nonbank debts are treated symmetrically under the personal bankruptcy law.

The analyses use data that the bank regulator collects on the universe of bank and nonbank issued cards for the purposes of prudential regulation. The data cover the period from December 2014 through December 2017, and they include the limit and balance of each card at the end of each month and indicators of whether required payments are delinquent. The sample contains 596 million card-month observations on about 9 million individuals and 25 lenders. Because every card issued by every bank and nonbank issuer appears in the data, it is possible to measure the credit exposure of an individual across lenders over time. Demographic data from the tax authority on the age, gender, income tax bracket, and county of residence of each individual are merged into these data.

Basic patterns in the behavior of the two kinds of issuers are consistent with nonbank issuers engaging in learning by lending. Nonbank issuers serve a broader set of first-time borrowers than banks, and the initial limits they provide are lower and show less variation. Analysis of the initial limits of first-time borrowers who subsequently default and those who do not is informative about how much the two kinds of issuers learn before lending. Nonbank issuers give the two groups nearly identical initial limits, so their initial limits appear to reflect little information about eventual default. Banks give borrowers who subsequently default initial limits that are low and tightly clustered, while they give borrowers who do not default limits that are higher and widely dispersed. Bank initial limits therefore reflect information

about default risk at the time of issuance, which is consistent with banks engaging in a more extensive screening process than nonbank issuers and setting limits based on what screening reveals. Nonbank cardholders are considerably more likely to default in the months following issuance, and nonbank issuers cancel a greater share of the cards they issue. The limits of nonbank cardholders who remain current more than double within two years of issuance, an increase far larger than the one experienced by bank cardholders who remain current. These patterns are consistent with nonbank issuers lending to learn about credit risk and extending additional credit to those who appear creditworthy.

The revelation of private information could increase competition to serve borrowers who are deemed to be creditworthy. The formation of a joint venture between one of the nonbank issuers, referred to as the JV NBI, and a bank in May 2015 provides an opportunity to test this idea. The JV NBI's cards continued to bear the nonbank's brand and to be issued through the nonbank's locations, but its portfolio and new originations were consolidated into the bank's balance sheet, so positive and negative information about its borrowers became observable to all banks. Nonbank issuers continued to see only negative information about them. Relative to borrowers at other nonbank issuers, the JV NBI's borrowers experience an increase in the credit limits they obtain from other banks of almost 10 percent of the mean bank credit limit. There are no pretrends, and the relative increase grows over time. The nonbank credit limits of the same borrowers change little, consistent with nonbank issuers obtaining no new information about them.

Two further sets of results indicate that banks responded to the information that was revealed. First, the information the JV NBI accumulated through lending has substantial value for predicting default on bank issued cards. Default prediction models estimated under the information sets available to banks before and after the transaction indicate that the JV NBI's credit limits and balances considerably improve out of sample predictive performance. The revealed information also absorbs a substantial share of the default risk that banks would otherwise attribute to young, female, and low-income borrowers. Second, banks directed

credit toward the borrowers whom this information identified as creditworthy. Among JV NBI borrowers with no bank credit before the transaction, those whose predicted default falls the most when the JV NBI information is incorporated experience the largest increases in bank credit limits.

If other banks compete away the returns to learning by lending once information is revealed, the JV NBI should begin to act like a bank following the transaction. It does. Relative to other nonbank issuers, the JV NBI offers higher initial limits to first-time borrowers, experiences lower default and cancellation rates, and grants smaller limit increases to those who perform, which suggests that it screens more extensively before issuance and relies less on learning by lending. The JV NBI also changes whom it serves. Nonbank issuers are more likely than banks to serve young, female, and low-income borrowers, who may be less likely to be able to provide verifiable information for a credit review. After the transaction, the shares of the JV NBI's first-time borrowers who are young and who are female fall by about 11 percentage points relative to other nonbank issuers, and the share who are low income falls as well.

These findings relate to the literature on credit information sharing. Theoretical work shows that sharing information among lenders reduces adverse selection, disciplines borrowers, and limits the rents that informed lenders can extract (Klein, 1992; Pagano and Jappelli, 1993; Vercammen, 1995; Padilla and Pagano, 1997, 2000; Vives, 1990; Bouckaert and Degryse, 2004; Bennardo et al., 2015). Empirical work documents that more extensive information sharing is associated with deeper credit markets and lower default rates across countries (Jappelli and Pagano, 2002; Djankov et al., 2007; Brown et al., 2009; Bruhn et al., 2013), and studies of changes in registry coverage and in the retention of credit information find that borrowers whose histories become observable obtain more credit on better terms (Hertzberg et al., 2011; Doblas-Madrid and Minetti, 2013; González-Uribe and Osorio, 2014; Bos and Nakamura, 2014; Liberman et al., 2018; Liberti et al., 2022). This work focuses on borrowers who already have credit histories to share. It does not consider how information

sharing affects the incentives of lenders to produce information about borrowers who do not yet have one.

The paper also relates to work on relationship lending, in which informational rents sustain lending to borrowers who other lenders cannot evaluate, and competition erodes those rents (Sharpe, 1990; Rajan, 1992; Petersen and Rajan, 1994, 1995; Dell'Ariccia et al., 1999; Boot and Thakor, 2000; Marquez, 2002; Hauswald and Marquez, 2006), and to studies of consumer credit card markets that document the importance of private information and adverse selection in this market (Ausubel, 1999; Agarwal et al., 2010; Einav et al., 2013; Agarwal et al., 2018; Nelson, 2025). The evidence presented here is distinctive in that it compares lenders operating under different information regimes in the same market, uses a transaction that changed the regime for one lender's borrowers while leaving the borrowers and the lender's retail operations unchanged, and traces the consequences for borrowers at the margin of financial access rather than for borrowers already served by banks. The granular data analyzed allow for illustration of the learning by lending mechanism that supports relationship lending.

The rest of the paper is organized as follows. Section II describes the data and the information environment. Section III presents evidence that nonbank issuers learn by lending. Section V analyzes how banks respond when information about the JV NBI's borrowers is revealed, and Section V shows that this information predicts default and that banks allocate credit toward the borrowers it identifies as creditworthy. Section VI examines how the JV NBI's lending changes after the transaction. Section VII concludes.

II. Data and Institutional Setting

A. Data

Analyzing the provision of credit by bank and nonbank card issuers and the impact of the information environment on lending requires data from regulatory filings and tax-return data. The bank regulator, called the Superintendencia de Bancos e Instituciones Financieras (SBIF) until 2019 when it became a part of the Comision para el Mercado Financiero (CMF), collects information on the universe of bank issued and nonbank issued cards for the purposes of prudential regulation. The data include the limits and balances of each card held by all cardholders at the end of each month. They also contain indicators of whether required payments are delinquent by 30, 60, 90, 180, and more than 365 days.

The sample used in the analyses covers observations from December of 2014 through December of 2017. It is constructed by combining information drawn from the bank and nonbank issuer files. The resulting sample includes 596,234,025 observations covering 8,998,352 different individuals with 25 lenders. Basic demographic data from the Servicio de Impuestos Internos (SII), the Chilean tax authority, are merged into these data. These include the age, gender, county of residence, and income tax bracket. There are five income brackets: monthly taxable income below CLP 583,173; CLP 583,173-1,295,940; CLP 1,295,940-2,159,900; CLP 2,159,900-3,023,860; and above CLP 3,023,860.

Table I presents descriptive statistics for the data sets. The top panel describes the credit panel, in which the unit of observation is a card-month. 45 percent of card-months correspond to nonbank issued cards. Credit limits are highly skewed. The average limit is 1.7 million pesos, but the median is 507 thousand pesos, and the 10th and 90th percentiles are 100 thousand and 3.6 million pesos. Balances are similarly skewed. The average balance is 448 thousand pesos, the median is 64 thousand pesos, and at least 10 percent of card-months carry no balance. A required payment is 90 or more days delinquent in 2

percent of card-months. The lenders in the sample typically set rates at the maximum level allowed by regulation. As a result, there is very little variation in the rates offered to different borrowers or the rates offered over time.

The bottom panel describes the individuals who hold these cards. The average cardholder is 44 years old as of the end of 2014, and the 10th and 90th percentiles of the age distribution are 24 and 66. 53 percent of cardholders are female, and 76 percent are in the first income tax bracket.

B. The Information Environment

In January 2015, credit cards were provided in Chile by six nonbank issuers and seventeen banks. The nonbank issuers were all associated with retail chains, but they were separate legal entities, and their cards could be used outside of the retail store like bank-issued cards. Foley and Hurtado (2016) provides a description of the financial services activities at Falabella, a multisegment retailer based in Chile that issued credit cards. Nonbank card issuers are differentiated from bank card issuers by not taking deposits; they are typically funded through commercial paper, bank debt, and equity. Both bank and retailer debts are treated symmetrically by the personal bankruptcy law implemented in Chile in 2014, and there is no difference in the expected priority of recoveries of retailers relative to banks.

Chile lacked standardized credit score information, and the two kinds of card issuers faced distinct information environments shaped by the laws governing the privately owned credit bureau, which was managed by Equifax, and the bank regulator, then called the SBIF. Figure I illustrates the role these entities played. Both nonbank and bank issuers were required to share information with the credit bureau, but they only had to share negative information. As indicated by the black arrows, credit bureau information could be accessed by any bank or nonbank issuer, allowing all issuers to observe nonperforming accounts. However, performing nonbank card accounts were observable only to their issuer.

Although the bank regulator collected information on all issued cards for prudential supervision and regulatory oversight, only some information was observable to each of the banks. Any bank could observe the limits and balances of individual bank cardholders who were current on their obligations, or positive information, and information indicating that individual cardholders were not current, or negative information on any individual bank issued card account. Thus, the black and gray arrows in Figure I indicate that bank issuers operated under a regime in which the full credit histories of bank issued cardholders were available. Nonbank issuers were not required to share information with the bank regulator.

III. Learning by Lending

A. Incentives Under the Two Regimes

These distinct information environments give rise to hypotheses about how the two types of issuers might behave when serving new borrowers. Nonbank issuers have an incentive to learn which potential borrowers are creditworthy because they can keep the positive information they learn private. This learning might occur through lending. The nonbank issuer might serve a larger number of new borrowers and issue cards with low limits to this wide range of applicants. For those cardholders who are profitable to serve and are deemed to be able to meet their future obligations, the nonbank issuer can increase credit limits. For cardholders who do not make required payments, the nonbank issuer can reduce limits and cancel cards, reducing the scope of losses. The returns to this kind of activity are likely to be higher when serving opaque borrowers whose creditworthiness is not obvious. Nonbank issuers can absorb losses on nonperforming borrowers with rents they can earn over time on performing profitable borrowers whose credit history is not observable to other capital providers.

Bank issuers cannot keep positive information about their cardholders private, so they

do not have this incentive to learn by lending. The positive information on account holders can be observed by other banks, which can compete away profits. Bank issuers therefore have an incentive to engage in extensive screening ex ante and to offer higher limits to card applicants who appear to be more creditworthy. Bank issuers should be less likely than nonbank issuers to provide cards to borrowers who are not easy to evaluate.

B. first-time borrowers and Initial Credit Limits

Basic patterns in a data sample of first-time borrowers are consistent with nonbank lenders engaging in learning by lending, while bank lenders face different incentives. A first-time borrower is defined as an individual who did not have a card in December 2014 and obtained one during 2015. Attention is restricted to borrowers who originate with exactly one card in their first observed month, and borrowers are classified as having a nonbank or bank card, depending on whether that first card is nonbank or bank.

Figure II provides information about the share of borrowers at nonbank and bank issuers who are first-time borrowers in 2015. 11.5% of the nonbank borrowers are new borrowers but only 6.7% of bank borrowers are new. This pattern is consistent with nonbank issuers making loans to a broader set of new people each year in order to learn who is creditworthy.

Figure III displays initial limits for first-time borrowers. The first box and whisker plot is for nonbank cardholders and the second for bank cardholders. Initial credit limits on nonbank cards are lower and show less variation than those for bank cards. This is consistent with nonbank issuers providing cards with low limits to learn about the creditworthiness of borrowers.

The next two box and whisker plots provide data on nonbank issued cardholders who do and do not default within 24 months of opening their card. The last two plots provide similar data for those with bank issued cards. Defaults are defined as occurring when a cardholder is at least three months delinquent in making a required payment. Bank issuers appear to

offer a wider range of initial limits, particularly to cardholders who prove to be better credit risks. Nonbank issuers give new borrowers who do and do not subsequently default similar initial limits. These patterns are consistent with bank issuers engaging in a more extensive screening process than nonbank issuers and setting limits based on what screenings reveal, assuming screenings predict subsequent default.

C. Default, Cancellation, and Limit Growth

The three panels of Figure IV illustrate how the likelihood of default, the rate of cancellation, and credit limits evolve for first-time borrowers. Panel A captures the incidence of default for first-time borrowers following card issuance. The share of nonbank cardholders who are in default increases to 16% within six months, but it peaks at less than 5% for bank issued cardholders. Cumulatively, 44% of all new nonbank cardholders default within the first two years of holding their card, while only 25% of bank cardholders do so.

The decline in default rates among cardholders after the first six or seven months in part reflects the cancellation of cards, which is depicted in Panel B. Cancellation of cards remains low during the first few months following their issuance, but then increases. It reaches 13% for nonbank cards seven months after issuance. The cancellation rate for bank issued cards is much lower; it peaks at 7% seven months after issuance. Cumulatively, 45% of all new nonbank cards issued to first-time borrowers are cancelled within two years, while only 30% of bank cards are.

Panel C displays how credit limits change for first-time borrowers following card issuance. The black line with circular markers plots the path of the credit limit of nonbank cardholders who do not default. Their credit limit more than doubles within 24 months of obtaining their card. The grey line with triangular markers illustrates the path of bank cardholders who do not default. Their limits increase by almost 50 percent, but this increase is 62 percentage points lower than the limit increase experienced by nonbank cardholders who do not default.

The two lines marked by squares and diamonds indicate that limits decrease by more than half for cardholders who default, and the extent of decline is similar for holders of nonbank and bank cards.

These patterns are consistent with nonbank issuers engaging in less screening. They appear to provide lower initial limits and learn about the creditworthiness of cardholders over time. Nonbank cardholders are more likely to fail to make required payments, and the nonbank issuers cancel a greater share of the cards they issue. These patterns suggest that nonbank issuers lend to learn about credit risk and extend additional credit to those who appear creditworthy.

IV. Information and Competition to Serve Borrowers

One idea that is implicit in the hypothesized learning by lending dynamics is the idea that public information increases competition in credit markets. Put differently, when potential lenders can observe both positive and negative information about a potential borrower, they will compete to serve borrowers who are deemed to be creditworthy. The gains associated with identifying creditworthiness are then likely to be competed away, diminishing the incentive for a lender to lend to learn.

A. The Joint Venture

The formation of a joint venture between one of the nonbank lenders and a bank during the sample period provides an opportunity to analyze the impact of information revelation. In May of 2015, one of the nonbank lenders with ties to a retail chain, referred to as JV NBI, entered into a joint venture with a bank. Following this transaction, the credit cards issued by JV NBI continued to bear the retailer's brand and to be primarily issued through the retailer's locations. The credit card portfolio and new originations were transferred to a

separate subsidiary of the bank and consolidated into the bank's balance sheet.

Figure V depicts how the information regime changed. Positive and negative information about the borrowers in this portfolio became observable to all banks. The number of borrowers whose positive and negative information was observable to banks increased from about 7 to 8.8 million. Since nonbank lenders do not have access to the regulatory banking data, there was no change in the information that nonbanks observe about the lender's clients after the transaction; they continue to see only negative information. If information revelation promotes competition in credit markets, one would expect to see banks take action to serve the creditworthy borrowers who were identified and served by JV NBI following the transaction.

B. Bank Credit Limits After the Transaction

To analyze these issues, it is helpful to construct and analyze a monthly panel dataset of all borrowers with a nonbank issued card at the time of the transaction. For each borrower, it is possible to measure the sum of credit limits across all bank issued cards and the sum of credit limits across all nonbank issued cards. The JV NBI and bank subsidiary involved in the transaction are excluded from these aggregates.

Columns (1)-(4) of Table II present the results of specifications in which the dependent variable is the aggregate bank credit limit of a borrower. JV NBI is defined to be a dummy equal to one for individuals who had a card with JV NBI in the month of the transaction and zero for other NBIs. JV NBI is interacted with a dummy equal to one for all months after the transaction in the first two specifications. In the subsequent two specifications, it is interacted with a set of dummies equal to one for the periods 1-5 months before the transaction, 1-5 months after the transaction, 6-10 months after the transaction, 11-15 months after the transaction, and 16 or more months after the transaction. All specifications include fixed effects for each individual. The specifications in the odd numbered columns also include

month fixed effects, and the specifications in the even numbered columns also include county × month fixed effects.

The 258.92 coefficient in the first column implies that those individuals who had a credit card issued by JV NBI experience a change in their bank credit limit that is 259 thousand pesos more than the change in the bank credit limit of those who only had nonbank issued cards from other lenders. This relative increase is almost 10% of the mean value of bank card limits. The 180.94 coefficient in the second column, which includes county x month fixed effects, is smaller but remains highly statistically significant. These findings are consistent with the view that banks disproportionately increase their lending to borrowers who were served by nonbanks when information about their creditworthiness becomes available.

The coefficients on the interaction terms in columns (3) and (4) trace out this increase in the relative change in bank credit limits over time. The coefficients on JV NBI interacted with the dummy equal to one for the period 1-5 months before the transaction are small, suggesting that there are no pretrends in the relative changes. The coefficients on the interactions for the period after the transaction increase over time, suggesting that it takes time for banks to serve the newly observable borrowers.

C. Nonbank Credit Limits as a Placebo

As a placebo test, it is informative to examine the response of nonbank lenders to the transaction. Nonbank lenders are not a part of the bank information regime so they are not supposed to obtain any new information about JV NBI's borrowers following the transaction. Therefore, the aggregate nonbank credit limit of JV NBI borrowers should not disproportionately change following the transaction.

Columns (5)-(8) of Table II replicate the specifications in the first four columns but the dependent variable is the aggregate nonbank credit limit of borrowers. The 38.43 coefficient on the JV NBI dummy interacted with the post transaction dummy in column (5) is positive

and statistically significant but it is much smaller than the coefficient on this variable in the first column. The other specifications also indicate that those individuals who had a credit card issued by JV NBI experience only a slightly larger change in their nonbank credit limit than the change in the bank credit limit of those who only had nonbank issued cards from other lenders. Figure VI traces out the relative changes in bank and nonbank credit limits by month. Appendix Figure X replicates this figure with individual and month fixed effects in place of individual and county $\times$ month fixed effects. The relative increase in bank credit limits is somewhat larger in this specification, and the relative change in nonbank credit limits remains small.

V. Information Revelation and Predicted Default

The evidence in Section V indicates that banks disproportionately increased the credit limits of JV NBI borrowers after the transaction made positive information about these borrowers observable, and the muted response of nonbank lenders suggests that this increase reflects the change in the information regime rather than some other feature of the JV NBI's borrowers. These findings leave two questions open. The first is whether the information that the JV NBI accumulated by lending has predictive value for default beyond the information that banks could already observe. The second is whether banks directed credit toward the borrowers whom the newly observable information identified as creditworthy, as opposed to extending credit to the JV NBI's borrowers indiscriminately. If nonbank issuers learn by lending, both should hold. The information a nonbank issuer accumulates about its cardholders should be informative about their creditworthiness, and once that information is revealed, profit-maximizing competitors should use it to serve the borrowers it identifies as good risks.

Analysis of these questions is also helpful in addressing alternative explanations for the results presented in Section . For example, if the formation of the joint venture by JV NBI

reflected the fact that the JV NBI faced financial constraints at the time of the transaction, then the subsequent growth in the bank limits offered to JV NBI borrowers might simply reflect that these borrowers had unmet demand for credit. Evidence that bank limit increases are concentrated among borrowers who are revealed to be creditworthy suggests that this response by banks reflects more than just a response to unmet demand.

A. Predicting Default Risk

To address the question of whether the information that the JV NBI accumulated by lending has predictive value for default, the analysis adopts the perspective of a bank evaluating the JV NBI's borrowers and estimates default prediction models under the information sets available before and after the transaction. All models use the same sample of individuals who held a JV NBI card in December 2014. The dependent variable is a dummy equal to one if the borrower is at least 90 days delinquent on any bank issued card at any point between January and May 2015. All predictors are measured as of December 2014. The first set of predictors consists of demographic characteristics: a dummy equal to one for young borrowers, defined as those whose age is strictly below the 10th percentile of the age distribution, a dummy equal to one for female borrowers, and a dummy equal to one for low-income borrowers, defined as those in the first income tax bracket. The second set adds the borrower's total bank credit limit and total bank balance, summed across bank issued cards. Together, the demographic characteristics and bank credit information represent what a bank could observe about these borrowers before the transaction, and the model that uses them is referred to as the Pre-JV Model. The third set adds what the transaction revealed, namely the borrower's credit limit and balance at the JV NBI, and the model that includes them is referred to as the Post-JV Model. Because all models predict defaults that occur before June 2015, when the JV NBI information became available to banks, the comparison holds the estimation sample and the prediction horizon fixed and varies only the information

used to predict default. All models include county fixed effects, and credit limits and balances are measured in millions of pesos.

Table III reports average marginal effects. Column (1) presents the model that uses demographic characteristics alone. Young borrowers have a predicted default probability that is 4.75 percentage points higher than that of other borrowers, relative to a default rate of 6.11 percent in the sample. Female borrowers have a 0.86 percentage point lower predicted default probability than male borrowers, and low-income borrowers have a 1.76 percentage point higher predicted default probability, nearly 30 percent of the sample default rate. Column (2) adds bank credit limits and balances. An additional CLP 1 million in bank credit limits is associated with a 0.66 percentage point lower probability of default, while an additional CLP 1 million in bank credit card balances is associated with a 1.23 percentage point higher probability of default. The coefficient on the low-income dummy falls to 0.49, suggesting that bank credit information captures part of the risk associated with low income, while the coefficients on the young and female dummies remain similar.

Column (3) adds the JV NBI credit limits and balances. An additional CLP 1 million in JV NBI limits is associated with a 9.40 percentage point lower probability, and an additional CLP 1 million in JV NBI balances is associated with an 11.94 percentage point higher probability of default, nearly twice the sample default rate. These coefficients are more than ten times the corresponding coefficients on bank limits and balances, which fall to -0.36 and 0.76. The coefficient on the young dummy falls from 4.46 to 2.80, the coefficient on the female dummy is little changed, and the coefficient on the low-income dummy falls from 0.49 to -0.22. The information revealed by the transaction therefore absorbs a substantial share of the default risk that banks would otherwise attribute to young, female, and low-income borrowers, consistent with the view that the nonbank issuer's information is particularly valuable for assessing opaque borrowers.

The marginal effects in Table III describe in-sample associations. A bank deciding

whether to extend credit to a JV NBI borrower cares about how well the available information predicts default, so it is informative to evaluate the performance of the models out of sample. The sample is randomly divided into a training sample containing 70 percent of borrowers and a test sample containing the remaining 30 percent, with assignment stratified by default status and county.[2] The Pre-JV and Post-JV Models are re-estimated on the training sample and used to predict default in the test sample. Performance is summarized by the area under the receiver operating characteristic curve, or AUC, which equals the probability that a randomly selected defaulter is assigned a higher predicted default probability than a randomly selected nondefaulter. An AUC of 0.5 indicates that a model cannot distinguish defaulters from nondefaulters.

The Pre-JV Model achieves an AUC of 0.664 in the test sample, and the Post-JV Model raises it to 0.767. Put differently, a bank using the revealed information would rank a defaulter as riskier than a nondefaulter 77 percent of the time, compared with 66 percent using its own information alone. Appendix Figure XI plots the receiver operating characteristic curves for the two models.

The gain in predictive performance is concentrated among the borrowers banks could not previously observe. Panel A of Figure VII plots receiver operating characteristic curves for the two models for borrowers without a bank issued card in December 2014. For these borrowers, the Pre-JV Model has access only to demographic characteristics and county fixed effects, and it achieves an AUC of only 0.593. The Post-JV Model raises the AUC to 0.754, an improvement of 0.161. Panel B displays the curves for borrowers with a bank card. The Pre-JV Model achieves an AUC of 0.680 for these borrowers, and the Post-JV Model raises it to 0.769, an improvement of 0.089, roughly half of the gain for borrowers without a bank card. A bank relying on the information available before the transaction would have had limited ability to distinguish creditworthy from uncreditworthy borrowers who held only a

[2]Because the county fixed effects are estimated from the training sample only, a prediction is defined for a test borrower only if the training sample contains both defaulters and nondefaulters in that borrower's county. Borrowers in counties that fail this condition are excluded from both samples.

JV NBI card; with the information revealed by the transaction, it could do so nearly as well as for borrowers it already served.

Figure VIII indicates which predictors account for this performance improvement using the permutation importance of each predictor. Permutation importance is the decrease in test sample AUC when a single predictor is randomly permuted across borrowers, so that larger decreases indicate predictors on which the model relies more heavily. In the Pre-JV Model, bank credit limits and balances account for most of the predictive performance, and the demographic characteristics contribute little. In the Post-JV Model, the JV NBI credit limit and balance are the two most important predictors; permuting the JV NBI credit limit reduces the test sample AUC by 0.19, more than four times the 0.04 decrease from permuting the bank credit limit.

These results indicate that the information the JV NBI accumulated through lending had substantial value to banks. It is informative about default on bank issued cards, which is the outcome banks care about when deciding whether to extend credit. It adds to the predictive value of the information banks already held, and its predictive value is greatest for borrowers who were unobservable to banks before the transaction.

B. Revisions in Predicted Default and Bank Credit

The second question is whether banks directed credit toward the borrowers whom the JV NBI information identified as creditworthy. The analysis focuses on the borrowers for whom the information revealed by the transaction mattered most: JV NBI borrowers who had no bank credit limit in December 2014, the group examined in Panel A of Figure VII.

For each of these borrowers, the predicted probability of default from the model in column (3) of Table III can be subtracted from the predicted probability from the model in column (2), so that positive values indicate that incorporating the JV NBI information lowers a borrower's predicted default. Because these borrowers have no bank credit limits

or balances, the revision reflects only the JV NBI credit limit and balance and the change in how the demographic characteristics are weighted once that information is included. This difference serves as a proxy for the revision in a bank's assessment of the borrower's default risk when the JV NBI information becomes observable. If banks use the newly available information, borrowers with larger favorable revisions should obtain more bank credit after the transaction.

The borrowers are followed in a monthly panel from June 2015 through December 2017. The dependent variable is the borrower's total bank credit limit in thousands of pesos. Specifications include either month fixed effects or county × month fixed effects, so the comparisons are between borrowers observed in the same month or in the same county and month, and standard errors are clustered by borrower.

Columns (1) and (2) of Table IV relate bank credit limits to the continuous revision in predicted default over the full post-transaction period. The coefficient in column (1), which includes month fixed effects, implies that a borrower whose predicted default falls by 10 percentage points more when the JV NBI information is incorporated has a bank credit limit that is roughly 32 thousand pesos higher. This difference is approximately 25 percent of the mean bank credit limit in the sample. The coefficient in column (2), which includes county × month fixed effects, is similar.

Columns (3) and (4) interact the revision in predicted default with dummies for the periods 1-5 months, 6-10 months, 11-15 months, and 16 or more months after the transaction, where the first month is June 2015. No period is omitted, so each coefficient measures the relationship within its own window. In column (3), a 10 percentage point larger reduction in predicted default is associated with a bank credit limit that is about 6 thousand pesos higher in the first five months after the transaction, 19 thousand pesos higher in months 6-10, 31 thousand pesos higher in months 11-15, and 45 thousand pesos higher, or about 35 percent of the mean bank credit limit, from month 16 onward. The pattern in column (4),

which includes county × month fixed effects, is similar. As in Section V, the relationship builds over time rather than appearing all at once.

Columns (5)-(8) replace the continuous revision with a dummy equal to one for borrowers in the top quartile of the revision distribution within this sample, comparing the borrowers whose assessed risk improves the most with the remaining borrowers. The coefficient in column (5) implies that top-quartile borrowers have bank credit limits that are 50 thousand pesos higher on average over the post-transaction period, about 40 percent of the sample mean, and the coefficient in column (6) with county × month fixed effects is somewhat smaller. Column (7) indicates that this difference grows from 11 thousand pesos in the first five months to 72 thousand pesos, more than half of the sample mean, from month 16 onward, and column (8) displays a similar pattern.

These findings are consistent with banks using the newly observable information to allocate credit toward the JV NBI borrowers who are revealed to be less likely to default, rather than expanding credit uniformly to all borrowers who were previously unobservable to them. Information revelation appears to induce banks to compete away the returns to learning by lending.

VI. Information and Reduced Incentives to Learn by Lending

Thus far, evidence suggests that lenders uncover information about the creditworthiness of borrowers by lending to them, serving a broad set of borrowers by offering low initial limits, growing exposures to performing borrowers, and reducing exposures to those who do not perform. When the positive information about creditworthy borrowers who was held privately by the JV NBI becomes observable to other banks, these other banks step in to serve those borrowers, increasing the credit limits offered. Taken together, these findings

suggest that the JV NBI should begin to act like a bank as opposed to a nonbank following the transaction. Without the ability to earn returns from the private information obtained through lending, the JV NBI should have less incentive to uncover which borrowers are creditworthy. This change could reduce the extent to which opaque borrowers were able to obtain access to credit provided by the JV NBI.

A. Lending Behavior of the JV NBI After the Transaction

Table V presents analysis of how the lending behavior of the JV NBI changes after the transaction relative to that of other nonbank lenders. The tests analyze a sample of first-time borrowers served by the JV NBI or other nonbank lenders. Borrowers who obtain their first card between January and April 2015 form the pre-transaction cohort, and those who obtain their first card between July and December 2015 form the post-transaction cohort. Borrowers who obtain their first card in May or June 2015 are excluded. All outcomes are measured on the card held at origination. The specifications include a dummy for the JV NBI borrowers interacted with a dummy for those who obtain their first card after the transaction. All specifications include issuer fixed effects. The specifications in the odd numbered columns also include origination month fixed effects, and the specifications in the even numbered columns also include county $\times$ origination month fixed effects.

The dependent variable in the first two columns is the credit limit of first-time borrowers in the month of origination, measured in thousands of pesos. The 247.65 coefficient on the interaction term in the first column implies that, after the transaction, the JV NBI increases the initial limits it offers to first-time borrowers by 248 thousand pesos more than other nonbank lenders do. This increase is large relative to the average initial limit of 213 thousand pesos in the sample. The coefficient in the second column, which includes county $\times$ origination month fixed effects, is nearly identical.

Columns (3) and (4) present similar specifications in which the dependent variable is a

dummy equal to one if the borrower is 90 or more days past due on a required payment at any point during the 12 months following origination, and zero otherwise, multiplied by 100. The -3.77 coefficient in column (3) implies that, after the transaction, the share of the JV NBI's first-time borrowers who default within a year of origination falls by 3.8 percentage points more than the corresponding share of other NBI borrowers, a decline of roughly 13 percent relative to the sample default rate of 29 percent. Columns (5) and (6) replace default with a dummy equal to one if the card is cancelled within 12 months of origination, multiplied by 100. The coefficients indicate that the cancellation rate among the JV NBI's first-time borrowers falls by about 4 percentage points more than that of other NBI borrowers, roughly 16 percent of the sample mean.

The specifications in the last two columns analyze the credit limit growth of performing borrowers. The dependent variable is the percentage change in the credit limit between the month of origination and the twelfth month after origination, computed for borrowers whose initial limit exceeds 1,000 pesos, who do not default within 12 months of origination, and whose card remains open in the twelfth month. The -42.00 coefficient in column (7) implies that, after the transaction, the limit growth of the JV NBI's performing borrowers falls by 42 percentage points more than that of performing borrowers at other NBIs. This is a sizable change relative to the average limit growth of 103 percent in the sample, which indicates that performing borrowers typically see their limits roughly double over the first year. The result in column (8) is similar.

These patterns are consistent with the JV NBI shifting toward the lending behavior of banks following the transaction. It offers higher initial limits, experiences lower default and cancellation rates among its new borrowers, and grants smaller limit increases to those who perform, which suggests that it screens more extensively before issuance and relies less on learning by lending.

B. Demographics of Bank and Nonbank Borrowers

Existing literature suggests that certain kinds of borrowers are less likely to be able to provide the kind of verifiable information that would allow for a thorough credit review by a lending institution. Young borrowers are unlikely to have extensive credit histories or other evidence of an ability and willingness to make required loan payments. Women and low-income individuals are less likely to participate in the formal labor force. Table VI provides information about the share of young, female, and low-income borrowers at nonbanks and banks. Using 2015 data, these shares are computed as the number of borrowers in each category divided by the number of individuals who hold only nonbank cards or only bank cards, and multiplied by 100. The lenders involved in the joint venture are excluded from the calculation. Young borrowers are defined as those below the 10th percentile of the age distribution in the overall sample. 10.3 percent of nonbank borrowers are classified as young, but only 9.2 percent of bank borrowers are. 54.2 percent of nonbank borrowers are female, exceeding the bank share of 47.0 percent. low-income borrowers are identified as those in the first income tax bracket. 92.9 percent of nonbank borrowers are low income but only 71.9 percent of bank borrowers are. The third column of this table indicates that these differences are statistically significant. These patterns suggest that nonbanks are more likely to serve opaque borrowers than banks.

C. Lending to Opaque Borrowers After the Transaction

The analysis in Table VII considers the possibility that the JV NBI reduces the extent to which it serves young, female, and low-income borrowers more than other nonbanks after the transaction. Evidence of such patterns would be consistent with the idea that the JV NBI exerts less effort in determining the creditworthiness of borrowers who are hard to assess following the transaction because it is not able to keep any information that is obtained private. The sample in this analysis is comprised of all first-time borrowers in 2015, 2016,

or 2017 whose lender is the JV NBI or another nonbank.

The dependent variable in the specifications presented in the first four columns is a dummy equal to one for young borrowers, multiplied by 100. The specification in the first column includes a dummy for the JV NBI borrowers interacted with a dummy for those who obtain their first card after the transaction, along with issuer fixed effects and month fixed effects. The -10.59 coefficient on the interaction term in the first column implies that, after the transaction, the share of the JV NBI's first-time borrowers who are young falls by 10.6 percentage points more than the corresponding share at other nonbanks. Column (2) presents a specification that includes county $\times$ month fixed effects rather than month fixed effects, and the results are similar. The next two columns include interactions that trace the relative changes over time. The coefficient on the interaction for the months before the transaction is small and statistically insignificant, and the coefficients on the interactions for the months after the transaction grow over time. The results indicate that the relative prevalence of young JV NBI borrowers decreases over time rather than all at once. Panel A of Figure IX traces this pattern month by month using the specification with county $\times$ month fixed effects.

Columns (5)-(8) present similar specifications but the dependent variable is a dummy equal to one for female borrowers. The -10.82 coefficient in column (5) implies that, after the transaction, the share of the JV NBI's first-time borrowers who are female falls by 10.8 percentage points more than the corresponding share at other nonbanks. Panel B of Figure IX indicates that the decline appears within a few months of the transaction and persists. Columns (9)-(12) repeat the specifications once more; this time the dependent variable is a dummy equal to one for low-income borrowers. The coefficients in columns (9) and (10) are negative and statistically significant, indicating that the share of the JV NBI's first-time borrowers who are low income falls by 1.3 to 3.4 percentage points more than the corresponding share at other nonbanks after the transaction. These effects are smaller than those for young and female borrowers, which is not surprising given that 88

percent of first-time nonbank borrowers are low income, leaving limited scope for the share to decline. In column (12), which includes county × month fixed effects, the coefficient for the months before the transaction is positive and insignificant, and the coefficients for every period after the transaction are negative, with statistically significant declines 6-10 months and 16 or more months after the transaction. Panel C of Figure IX displays the same pattern; the monthly coefficients are negative in most months after the transaction, and the coefficient for 16 or more months after the transaction is statistically significant. The evidence therefore indicates that the JV NBI also reduces the extent to which it serves new low-income borrowers after the transaction, although the effect is smaller and less precisely estimated than for young and female borrowers.

VII. Conclusion

This paper analyzes how credit information shapes the behavior of credit card issuers. It studies the actions of bank and nonbank lenders in Chile, where these two groups operate in distinct information environments. Bank lenders report positive and negative information about their cardholders to a bank regulator, and this information is shared among all banks. Nonbank lenders, which are primarily comprised of retailer who issue cards, report only information about defaults. Nonbank lenders can therefore learn which borrowers are creditworthy and earn rents off of private information they obtain. Three main conclusions emerge.

First, imperfect information creates incentives to learn by lending. Relative to banks, nonbanks provide cards with low initial limits to a wide set of borrowers. In contrast, banks provide higher initial limits to borrowers, and these limits appear to reflect borrower credit risk. These patterns suggest that banks engage in more screening before issuance than nonbanks. Nonbanks increase the credit limits of borrowers who remain current, and they experience higher default rates than banks. They are also more likely to cancel cards that

they have issued. Nonbanks appear to engage in relationship lending while banks appear to engage in transactional lending.

Second, the revelation of private information about borrowers increases competition in credit markets. The paper uses the formation of a joint venture between a nonbank and bank lender to reach this conclusion. Prior to the joint venture, the nonbank had private information about the borrowers it served because the nonbank only need to report defaults. When the joint venture is formed the positive and negative information about these borrower become observable to all banks. The credit limits that banks provide to these borrowers increase. The increases are larger for those borrowers whose predicted default falls more because of the information that is revealed. One consequence of forming the joint venture is that the nonbank involved no longer can benefit from learning positive credit information. This gives rise to the final conclusion.

Third, increased information can limit lending to opaque borrowers. The nonbank that formed the joint venture had incentives to discover which potential borrowers were creditworthy when it could keep private and earn rents off of what it learned. When positive and negative information about borrowers is widely shared, other banks compete to serve borrowers who behave in creditworthy ways, reducing any rents that might be earned. The results illustrate that the nonbank that formed the joint venture changed its behavior around the time of this transaction. Relative to other nonbanks, the initial credit limits it offered increases, the growth in credit limits of its performing borrowers fell, the rate of default it experienced declined, and it cancelled fewer cards. Furthermore, there is evidence that the nonbank, on a relative basis, reduced its lending to segments of the population that are arguably opaque borrowers, namely young, female, and low-income borrowers.

These findings imply a tradeoff of increased information sharing: reforms with this objective might promote competition, but they might also reduce financial inclusion by limiting the incentives for capital providers to engage in learning by lending.

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Tables and Figures

	Mean	P10	P50	P90	Observations
Credit Panel Data					
Nonbank Issuer	0.45				596,234,025
Credit Limit	1,745.58	100.00	507.47	3,612.90	596,234,025
Credit Balance	448.36	0.00	64.35	1,071.40	596,234,025
90+ Day Delinquent	0.02				596,234,025
Demographic and Income Data					
Age	43.76	24.00	43.00	66.00	8,939,718
Female	0.53				8,939,064
First Income Tax Bracket	0.76				8,444,267

Table I: Summary Statistics

This table displays summary statistics for the data used in the analyses. The top panel provides data on the credit panel, which is drawn from regulatory filings with the SBIF and covers the universe of bank and nonbank issued cards from December 2014 through December 2017. The unit of observation is a card-month. Nonbank Issuer is a dummy equal to one if the card is issued by an NBI, and zero if it is issued by a bank. Credit Limit and Credit Balance are the credit limit and balance of the card at the end of the month, measured in thousands of pesos. 90+ Day Delinquent is a dummy equal to one if a required payment on the card is delinquent by 90 or more days at the end of the month, and zero otherwise. The bottom panel provides demographic and income data from the SII for the individuals who appear in the credit panel. The unit of observation is an individual. Age is measured in years as of December 31, 2014. Female is a dummy equal to one for female individuals, and zero otherwise. First Income Tax Bracket is a dummy equal to one for individuals whose monthly taxable income falls in the first income tax bracket, below CLP 583,173, in every month of the sample period in which their income bracket is observed, and zero otherwise. The columns report the mean, the 10th, 50th, and 90th percentiles, and the number of observations with non-missing values of each variable. Percentiles are not reported for dummy variables.

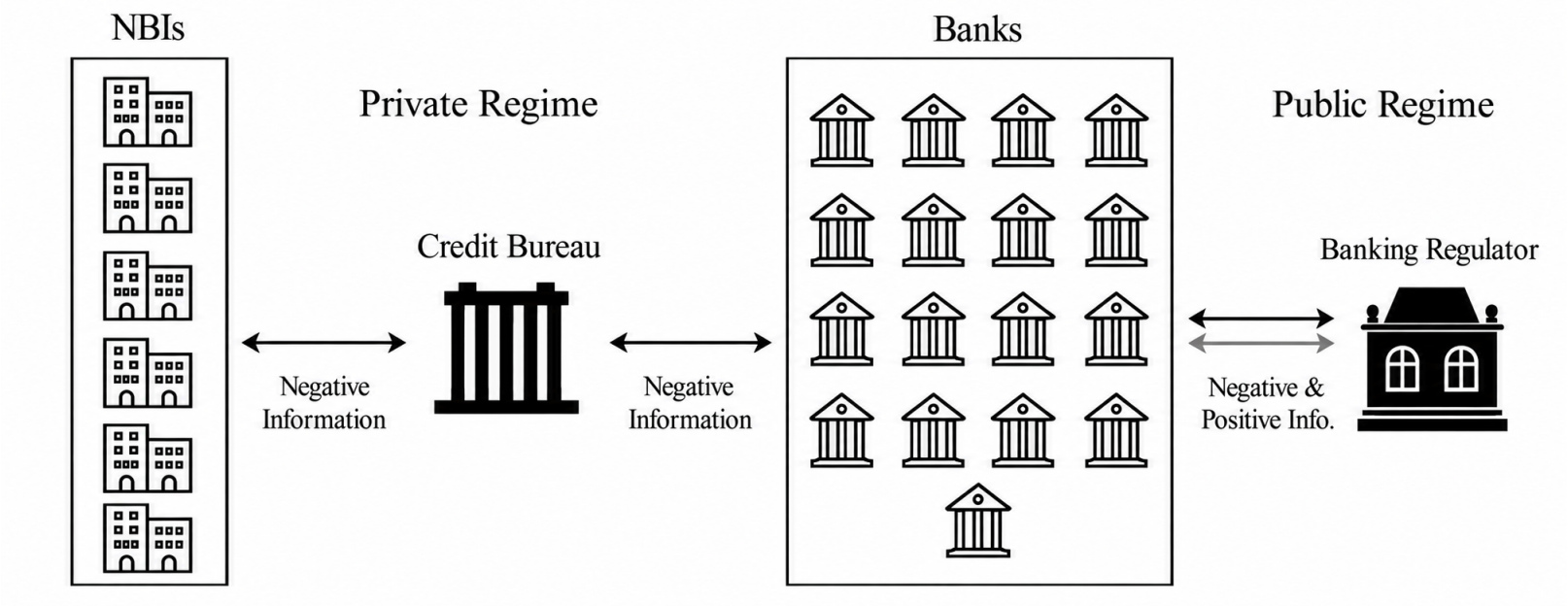


Figure I: Structure and Information Flows in Chile's Credit Card Market

This figure illustrates the information setting of Chile's credit card market in the 2015-2017 period. Six non-bank issuers (NBIs) share negative information with the Credit Bureau, Equifax, and each NBI can access these shared data. Seventeen banks share both negative and positive borrower information with the Banking Regulator, the Superintendencia de Bancos e Instituciones Financieras (SBIF). All banks are able to access these shared data, enabling them to observe the full credit histories of all bank borrowers.

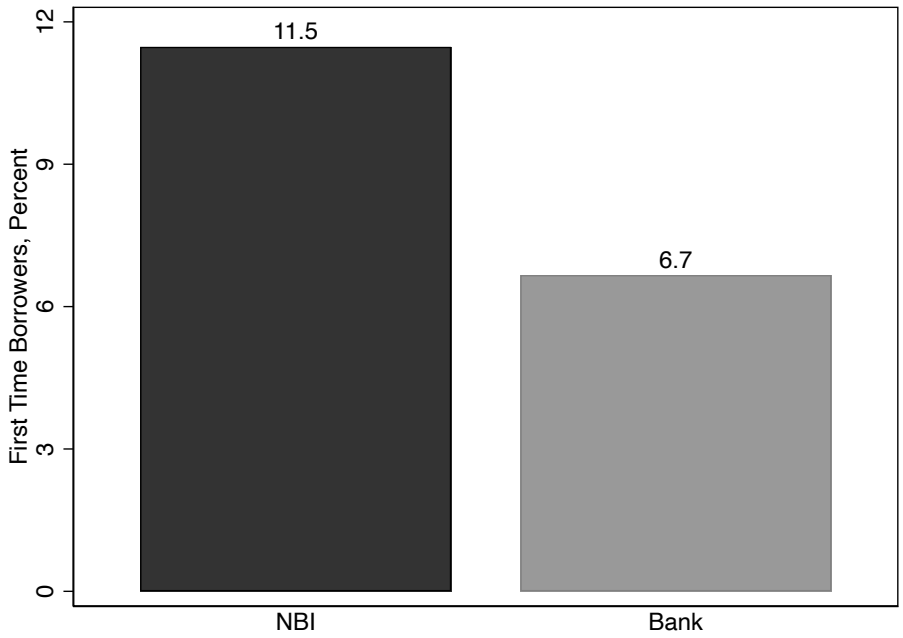


Figure II: Share of first-time borrowers

This figure displays the share of NBI and bank borrowers who are first-time borrowers. first-time borrowers are defined as individuals who obtained their first NBI or bank card during 2015. The share of first-time borrowers is computed as the number of first-time borrowers divided by the number of individuals with an active card in 2015, multiplied by 100 to express the share in percent. The lenders involved in the joint venture described in section V are excluded from this calculation.

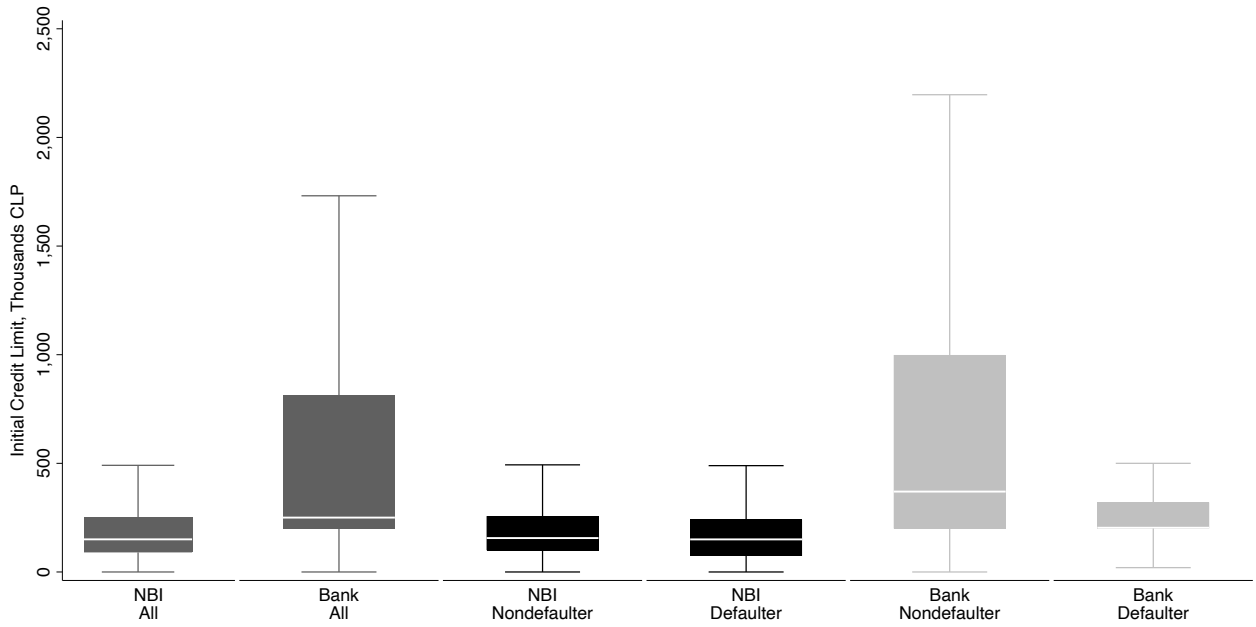
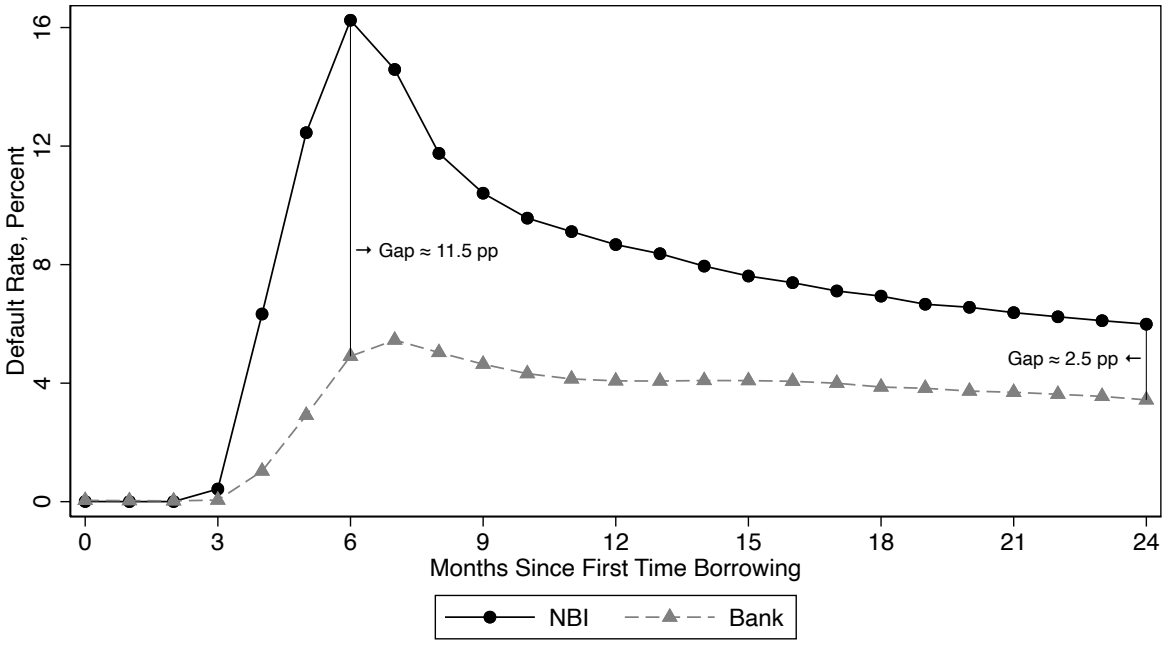


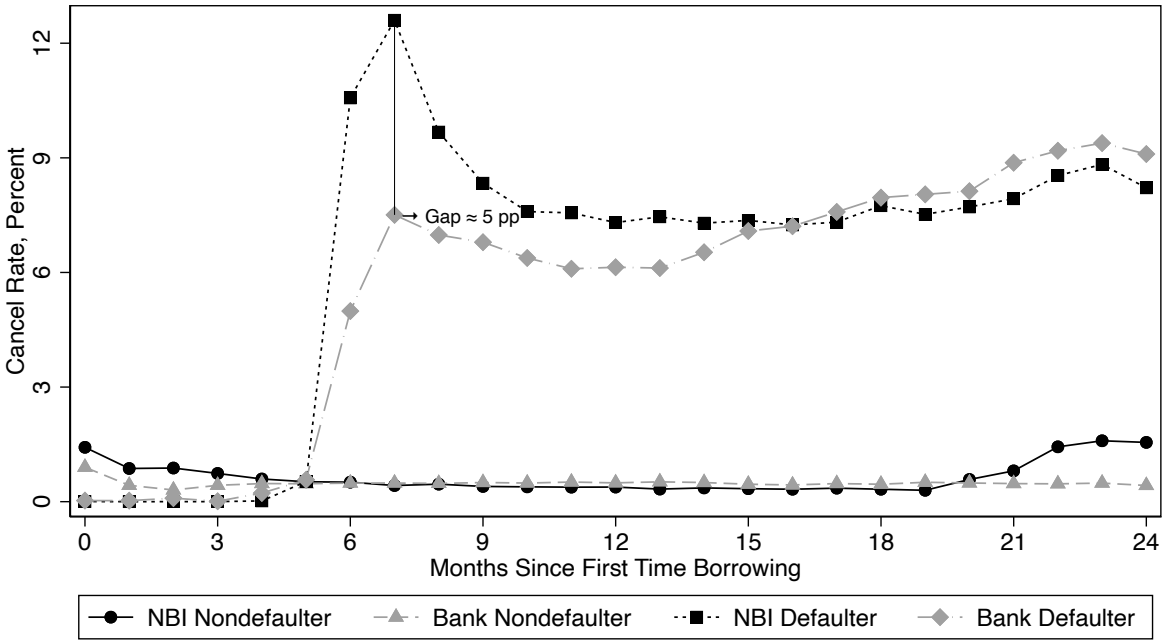
Figure III: Initial Credit Limits by Eventual Default Status and Lender Type

This figure plots the distribution of initial credit limits for different groups of first-time borrowers. First-time borrowers are defined as individuals who did not have an NBI or bank card at the end of 2014 but obtained one during 2015. The first pair of boxes display the limits of those who first obtain credit only from an NBI and those who first obtain credit from a bank. Each box shows the 25th percentile, median, and 75th percentile, and whiskers extending to the maximum and minimum values. The other boxes provide data for borrowers who subsequently defaulted and those who did not. Default is defined as occurring if a borrower is three or more months late making a required payment. The lenders involved in the joint venture described in section V are excluded from this calculation.

Panel A: Default Dynamics



Panel B: Cancellation Patterns



Panel C: Credit Limit Growth

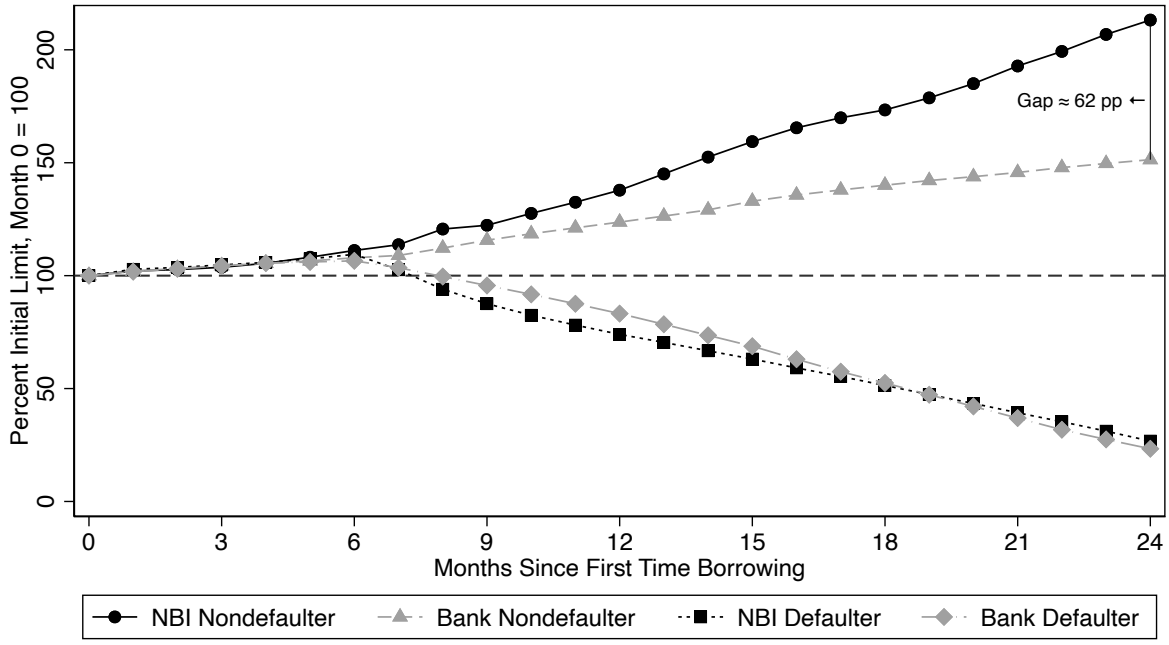


Figure IV: first-time borrower Default, Cancellation, and Credit Limit Growth

The three panels of this figure provide data on first-time borrowers, defined as individuals who obtained their first NBI or bank card during 2015. In all panels, borrowers are followed for the first 24 months after they first obtain a card. Panel A depicts the default rate for NBI borrowers and bank borrowers. The default rate is computed as the average of a default indicator equal to one for borrowers in default and zero otherwise, multiplied by 100 to express the rate in percent. Panel B shows the card cancellation rate for the four groups of borrowers analyzed in Panel A. The cancellation rate is computed as the average of a cancellation indicator equal to one in the last month a borrower-lender relationship is observed if the relationship ends before the last month of the sample, and zero otherwise, multiplied by 100 to express the rate in percent. Panel C displays an index of credit limits equal to 100 when cards are issued for four groups of borrowers: NBI borrowers who do not default, bank borrowers who do not default, NBI borrowers who do default, and bank borrowers who do default within the first 24 months after they first obtain a card. Default is defined as occurring if a borrower is three or more months late making a required payment. The lenders involved in the joint venture described in section V are excluded from this calculation.

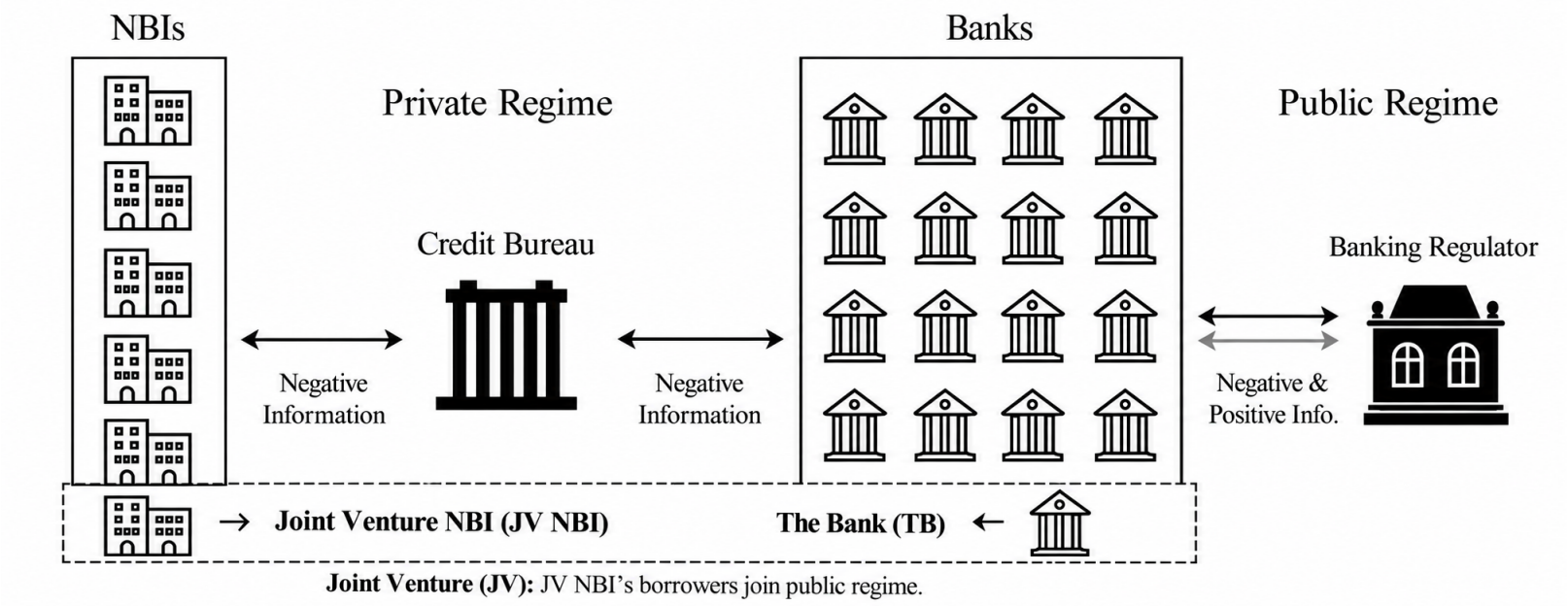


Figure V: Information Flows in Chile's Credit Card Market After the Joint Venture

This figure illustrates how the information setting depicted in Figure I changes following the joint venture described in section V. In May 2015, one of the six non-bank issuers (NBIs), referred to as JV NBI, enters into a joint venture with one of the seventeen banks, referred to as The Bank (TB). The credit card portfolio and new originations of JV NBI are transferred to a subsidiary of TB and consolidated into TB's balance sheet. Both negative and positive information about JV NBI's borrowers is now shared with the Banking Regulator, the Superintendencia de Bancos e Instituciones Financieras (SBIF), and becomes observable to all banks. The number of borrowers whose positive and negative information is observable to banks increases from about 7 million to 8.8 million. Other NBIs continue to share only negative information with the Credit Bureau, Equifax, and do not have access to the data shared with the SBIF, so the information that other NBIs observe about JV NBI's borrowers does not change.

	Bank Credit Limits				NBI Credit Limits			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$JV\ NBI \times \mathbf{1}\{t \geq 1\}$	258.92***	180.94***			38.43***	38.25***		
	(3.09)	(3.14)			(0.67)	(0.69)		
$JV\ NBI \times \mathbf{1}\{t \in [-5,-1]\}$			-8.17***	-1.27			13.14***	13.95***
			(1.27)	(1.30)			(0.29)	(0.29)
$JV\ NBI \times \mathbf{1}\{t \in [1,5]\}$			101.49***	73.15***			-1.65***	-0.36
			(1.34)	(1.37)			(0.29)	(0.30)
$JV\ NBI \times \mathbf{1}\{t \in [6,10]\}$			198.30***	144.42***			17.82***	17.69***
			(2.39)	(2.41)			(0.58)	(0.58)
$JV\ NBI \times \mathbf{1}\{t \in [11,15]\}$			238.53***	175.20***			28.76***	31.20***
			(3.45)	(3.65)			(0.73)	(0.74)
$JV\ NBI \times \mathbf{1}\{t \geq 16\}$			320.24***	225.77***			81.63***	81.47***
			(4.04)	(4.13)			(0.93)	(0.95)
Month Fixed Effects	Y	N	Y	N	Y	N	Y	N
County × Month Fixed Effects	N	Y	N	Y	N	Y	N	Y
Outcome Mean	2,769.15	2,803.56	2,769.15	2,803.56	1,026.24	1,036.28	1,026.24	1,036.28
Observations	196,169,634	192,965,138	196,169,634	192,965,138	196,169,634	192,965,138	196,169,634	192,965,138
R-squared	0.92	0.92	0.92	0.92	0.84	0.85	0.84	0.85

Table II: Credit Limits Around the Joint Venture

This table displays results of regressions analyzing credit limits around the time of the joint venture described in section V. The dependent variable is an individual's level of bank credit limits in columns 1-4 and of nonbank credit limits in columns 5-8, measured in thousands of pesos and summed across an individual's bank cards. JV NBI is a dummy equal to one for individuals who had a card with the NBI that enters the joint venture in the month of the transaction, and zero for other NBI borrowers. In columns 1, 2, 5, and 6, JV NBI is interacted with a dummy equal to one for all months after the transaction ($t \geq 1$); in columns 3, 4, 7, and 8, it is interacted with dummies for the time windows shown. The sample includes all borrowers with a nonbank issued card, including JV NBI cards, at the time of the transaction. The two lenders involved in the joint venture are excluded from the limit calculations. All specifications include individual fixed effects; the odd numbered columns add month fixed effects and the even numbered columns add county × month fixed effects. Standard errors, reported in parentheses, are clustered at the borrower level.

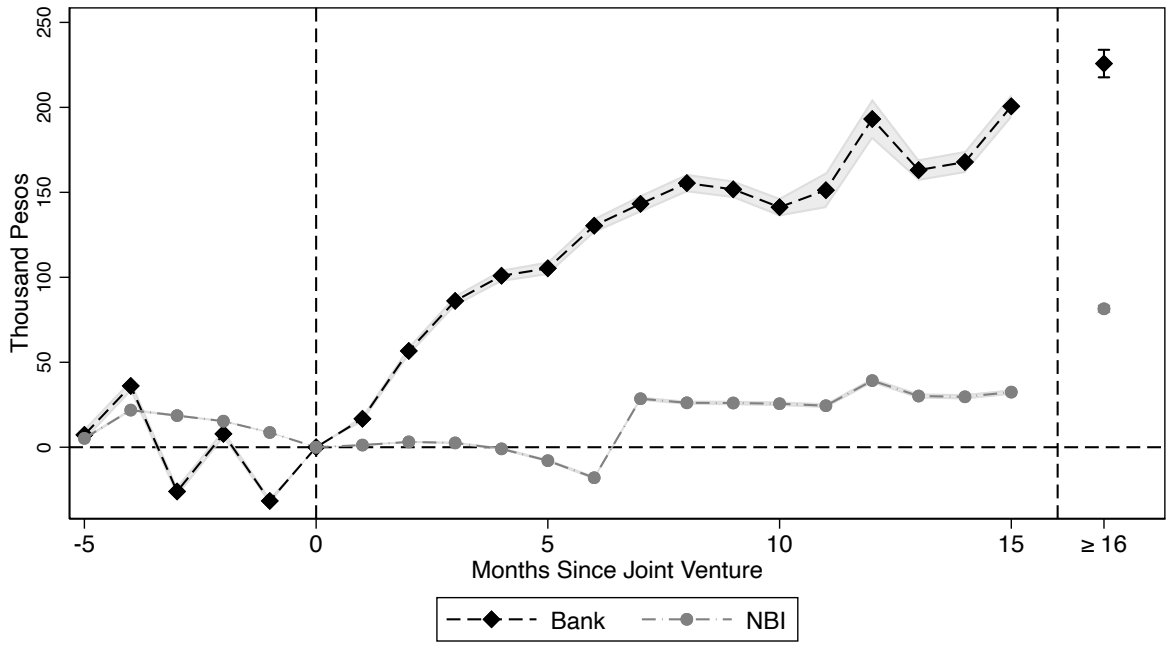


Figure VI: Dynamics of Credit Limits Around the Joint Venture

This figure displays coefficients from two specifications explaining credit limits around the time of the joint venture described in section V. The first of these explains an individual's level of bank credit limits. For individuals with more than one bank card, limits are summed across cards. The specification includes a dummy equal to one for individuals who had a card issued by the NBI that enters a joint venture with a bank in the month of the transaction. This dummy is interacted with dummies equal to one for each of the 5 months before the transaction, dummies equal to one for each of the 15 months after the transaction, and a dummy equal to one for 16 or more months after the transaction. The specifications include individual and county × month fixed effects. The dark diamonds display the coefficients implied by the interaction terms. The second specification explains an individual's level of credit limits of nonbank issued cards. For individuals with more than one nonbank issued card, limits are summed across cards. The specification is otherwise the same as the first specification, and the light circles display the coefficients implied by the interaction terms. The sample includes all borrowers with a nonbank issued card, including JV NBI cards, at the time of the joint venture. The lenders involved in the joint venture described in section V are excluded from the limit calculations. The gray shading displays 95% confidence intervals of the coefficient estimates. Standard errors are clustered at the borrower level.

	(1)	(2)	(3)
Young	4.75***	4.46***	2.80***
	(0.07)	(0.07)	(0.06)
Female	-0.86***	-0.93***	-1.00***
	(0.04)	(0.04)	(0.04)
Low Income	1.76***	0.49***	-0.22***
	(0.04)	(0.05)	(0.05)
Bank Credit Limit		-0.66***	-0.36***
		(0.01)	(0.01)
Bank Credit Balance		1.23***	0.76***
		(0.02)	(0.02)
JV NBI Credit Limit			-9.40***
			(0.13)
JV NBI Credit Balance			11.94***
			(0.13)
Default Mean	6.11	6.11	6.11
Observations	1,734,476	1,734,476	1,734,476
Pseudo R-squared	0.017	0.035	0.088

Table III: Nonbank Credit Information and Borrower Default

This table presents estimates from logit models predicting default among borrowers of the NBI that enters the joint venture described in section V. The sample includes all JV NBI borrowers observed in December 2014. The dependent variable is a dummy equal to one if a borrower is 90 or more days delinquent at any point from January through May 2015, and zero otherwise. Column 1 includes only borrower demographics. Column 2 adds bank credit limits and balances, and column 3 adds JV NBI credit limits and balances. Young borrowers are defined as those below the 10th percentile of the age distribution. Low-income individuals are those in the first income tax bracket, with monthly income below 583,173 pesos as of December 2014 (SII 2014). Credit limits and balances are measured as of December 2014 in millions of pesos. For individuals with more than one credit card, limits and balances are summed across cards. All specifications include county fixed effects and are estimated on the same sample, which excludes borrowers with missing demographic or county information. The table reports average marginal effects, expressed in percentage points, with standard errors in parentheses. Default Mean is the percentage of borrowers in the sample who experience a 90+ day delinquency. The table also reports the number of observations and McFadden's pseudo R-squared. Standard errors are robust to heteroscedasticity.

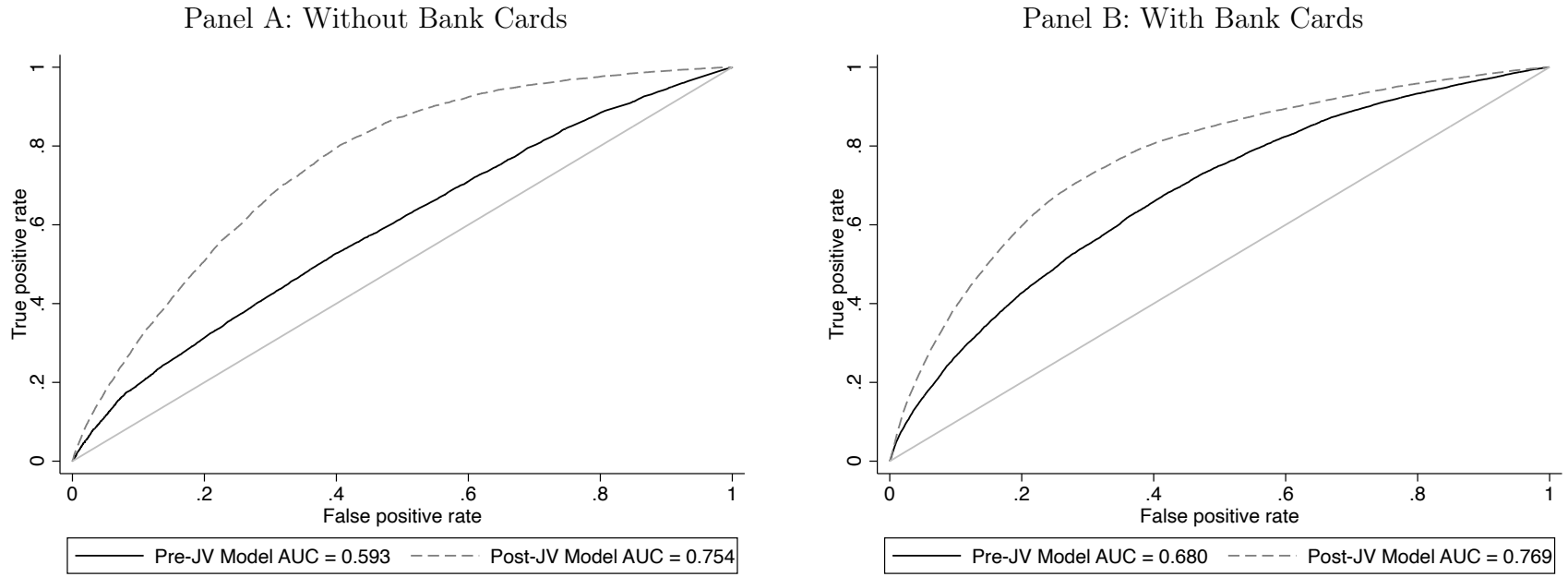


Figure VII: Receiver Operating Characteristic Curves for Borrowers Without and With Bank Cards

The two panels of this figure plot receiver operating characteristic (ROC) curves for two logit models predicting default among borrowers of the NBI that enters the joint venture described in section V. The sample includes all JV NBI borrowers observed in December 2014. The dependent variable is a dummy equal to one if a borrower is 90 or more days delinquent at any point from January through May 2015, and zero otherwise. The Pre-JV Model includes borrower demographics and bank credit limits and balances, and the Post-JV Model adds JV NBI credit limits and balances. Both models include county fixed effects, and variable definitions are as in Table III. Borrowers are randomly assigned to a training sample containing 70 percent of borrowers and a test sample containing the remaining 30 percent, with assignment stratified by default status and county; borrowers in counties whose training sample contains no defaulters or no nondefaulters are excluded. Both models are estimated on the training sample, and the curves are computed from predicted default probabilities in the test sample. Each point on a curve corresponds to a cutoff on predicted default probability above which a borrower is classified as a defaulter, and the curve plots the share of defaulters predicted to default (true positive rate) against the share of nondefaulters predicted to default (false positive rate). The solid black line displays the Pre-JV Model, the dashed gray line displays the Post-JV Model, and the light gray 45-degree line corresponds to a model with no predictive content. Panel A displays test-sample borrowers with zero bank credit limits in December 2014, and Panel B displays those with positive bank credit limits. The models are not re-estimated within these groups. The legend of each panel reports the area under each curve (AUC).

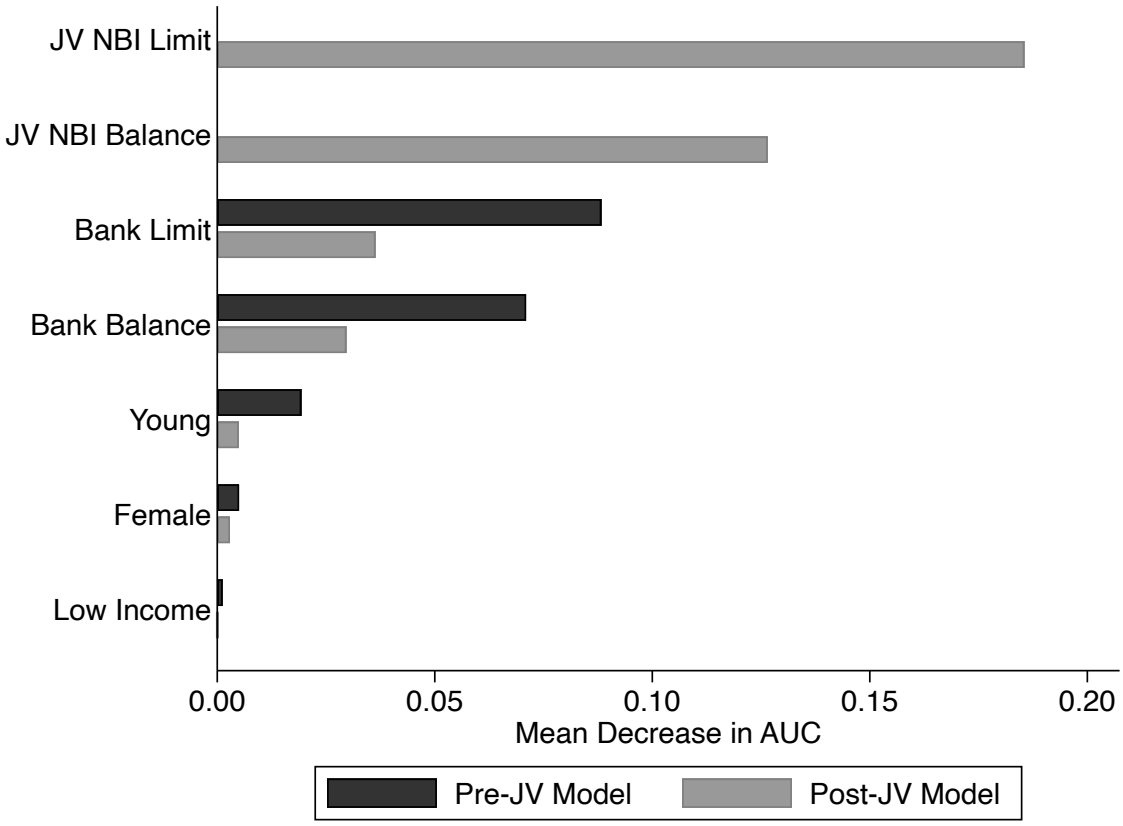


Figure VIII: Permutation Importance of Default Predictors

This figure displays the permutation importance of each predictor in two logit models predicting default among borrowers of the NBI that enters the joint venture described in section V. The sample includes all JV NBI borrowers observed in December 2014 with non-missing values of the dependent variable, all predictors, and county. The dependent variable is a dummy equal to one if a borrower is 90 or more days delinquent at any point from January through May 2015, and zero otherwise. The Pre-JV Model includes borrower demographics and bank credit limits and balances. The Post-JV Model adds JV NBI credit limits and balances. Both models include county fixed effects. Young borrowers are defined as those below the 10th percentile of the age distribution. Low-income individuals are those in the first income tax bracket, with monthly income below 583,173 pesos as of December 2014 (SII 2014). For individuals with more than one credit card, limits and balances are summed across cards. Borrowers are randomly assigned to a training sample containing 70 percent of borrowers and a test sample containing the remaining 30 percent, with assignment stratified by default status and county. Borrowers in counties whose training sample contains no defaulters or no nondefaulters are excluded. Both models are estimated on the training sample. For each model and predictor, the values of the predictor are randomly permuted across test-sample borrowers while the remaining predictors, the county fixed effects, and the estimated coefficients are held fixed, predicted default probabilities are recomputed, and the area under the receiver operating characteristic curve (AUC) is re-evaluated in the test sample. Permutation importance is the test-sample AUC of the model minus the AUC after permutation, averaged over 20 independent permutations. The dark bars display the permutation importance of each predictor in the Pre-JV Model, and the light bars display the permutation importance in the Post-JV Model. JV NBI credit limits and balances are not included in the Pre-JV Model, so no dark bars are shown for these predictors.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔPD	324.35***	319.60***			50.45***	44.19***		
	(57.31)	(58.94)			(3.10)	(3.12)		
$\Delta PD \times \mathbf{1}\{t \in [1,5]\}$			63.32**	62.36**			11.15***	9.57***
			(25.44)	(26.18)			(1.37)	(1.36)
$\Delta PD \times \mathbf{1}\{t \in [6,10]\}$			192.14***	189.90***			28.09***	24.46***
			(41.48)	(42.57)			(2.34)	(2.35)
$\Delta PD \times \mathbf{1}\{t \in [11,15]\}$			311.08***	306.73***			42.34***	36.95***
			(54.99)	(56.60)			(3.12)	(3.15)
$\Delta PD \times \mathbf{1}\{t \geq 16\}$			451.38***	444.54***			72.25***	63.44***
			(85.36)	(87.80)			(4.47)	(4.49)
Continuous ΔPD	Y	Y	Y	Y	N	N	N	N
Top Quartile ΔPD	N	N	N	N	Y	Y	Y	Y
Month Fixed Effects	Y	N	Y	N	Y	N	Y	N
County × Month Fixed Effects	N	Y	N	Y	N	Y	N	Y
Outcome Mean	126.95	128.43	126.95	128.43	126.95	128.43	126.95	128.43
Observations	13,633,800	13,425,728	13,633,800	13,425,728	13,633,800	13,425,728	13,633,800	13,425,728
R-squared	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Table IV: Bank Credit Limits and Revisions in Predicted Default

This table displays results of regressions relating bank credit limits to a proxy for revisions in banks' assessments of borrower default risk after the joint venture. The sample includes JV NBI borrowers with zero observed bank credit limits during December 2014-May 2015, followed from June 2015 through December 2017. The dependent variable is bank credit limits in thousands of pesos, summed across an individual's bank cards. ΔPD is predicted default from the Pre-JV Model minus that from the Post-JV Model in Table III, so that positive values indicate lower predicted default. Columns 1-4 use continuous ΔPD, and columns 5-8 use a dummy equal to one for borrowers in its top quartile. In columns 3, 4, 7, and 8, these variables are interacted with dummies for the time windows shown, where $t = 1$ is the first month after the transaction; no window is omitted. The odd numbered columns include month fixed effects and the even numbered columns include county × month fixed effects. Standard errors in parentheses are clustered at the borrower level.

	Initial Limit		Default		Cancellation		Limit Growth	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$JV\ NBI \times \mathbf{1}\{t \geq 1\}$	247.65***	245.40***	-3.77***	-3.70***	-3.83***	-3.81***	-42.00***	-41.54***
	(7.85)	(6.98)	(0.66)	(0.67)	(0.59)	(0.60)	(13.86)	(14.36)
Month Fixed Effects	Y	N	Y	N	Y	N	Y	N
County × Month Fixed Effects	N	Y	N	Y	N	Y	N	Y
Outcome Mean	213.29	210.04	28.70	28.70	23.39	23.30	103.38	101.28
Observations	409,809	398,954	409,809	398,954	409,809	398,954	257,486	250,865
R-squared	0.01	0.07	0.05	0.07	0.04	0.05	0.01	0.03

Table V: Credit Outcomes of First-Time Borrowers Around the Time of the Joint Venture

This table displays results of regressions analyzing the credit outcomes of first-time borrowers of the NBI that enters the joint venture described in section V and of other NBIs. First-time borrowers are defined as individuals who did not have an NBI or bank card in December 2014 and who hold exactly one card, issued by the JV NBI or by another NBI, in the first month in which they are observed with a card. The sample includes borrowers who obtain their first card between January and April 2015, before the transaction, or between July and December 2015, after the transaction; borrowers who obtain their first card in May or June 2015 are excluded. All outcomes are measured on the card held at origination. The dependent variable in columns 1 and 2 is the credit limit in the month of origination, measured in thousands of pesos. The dependent variable in columns 3 and 4 is a dummy equal to one if the borrower is 90 or more days past due on a required payment at any point during the 12 months following origination, and zero otherwise, multiplied by 100. The dependent variable in columns 5 and 6 is a dummy equal to one if the card is cancelled within 12 months of origination, defined as the borrower-lender relationship ending before the twelfth month after origination and before the last month of the sample, and zero otherwise, multiplied by 100. The dependent variable in columns 7 and 8 is the percentage change in the credit limit between the month of origination and the twelfth month after origination, computed for borrowers whose initial limit exceeds 1,000 pesos, who do not default within 12 months of origination, and whose card remains open in the twelfth month. JV NBI is a dummy equal to one for borrowers whose first card is issued by the NBI that enters the joint venture, and zero for borrowers whose first card is issued by another NBI. It is interacted with a dummy equal to one for borrowers who obtain their first card after the transaction ($t \geq 1$). All specifications include issuer fixed effects. The specifications in the odd numbered columns also include origination month fixed effects, and the specifications in the even numbered columns also include county × origination month fixed effects. Outcome Mean is the mean of the dependent variable in the estimation sample. Standard errors, reported in parentheses, are robust to heteroskedasticity.

	NBI	Bank	NBI-Bank Difference
	(1)	(2)	(3)
Young borrower share	10.3	9.2	1.1***
			(0.0)
Female borrower share	54.2	47.0	7.2***
			(0.1)
Low-income borrower share	92.9	71.9	21.0***
			(0.0)

Table VI: Demographics of Borrowers

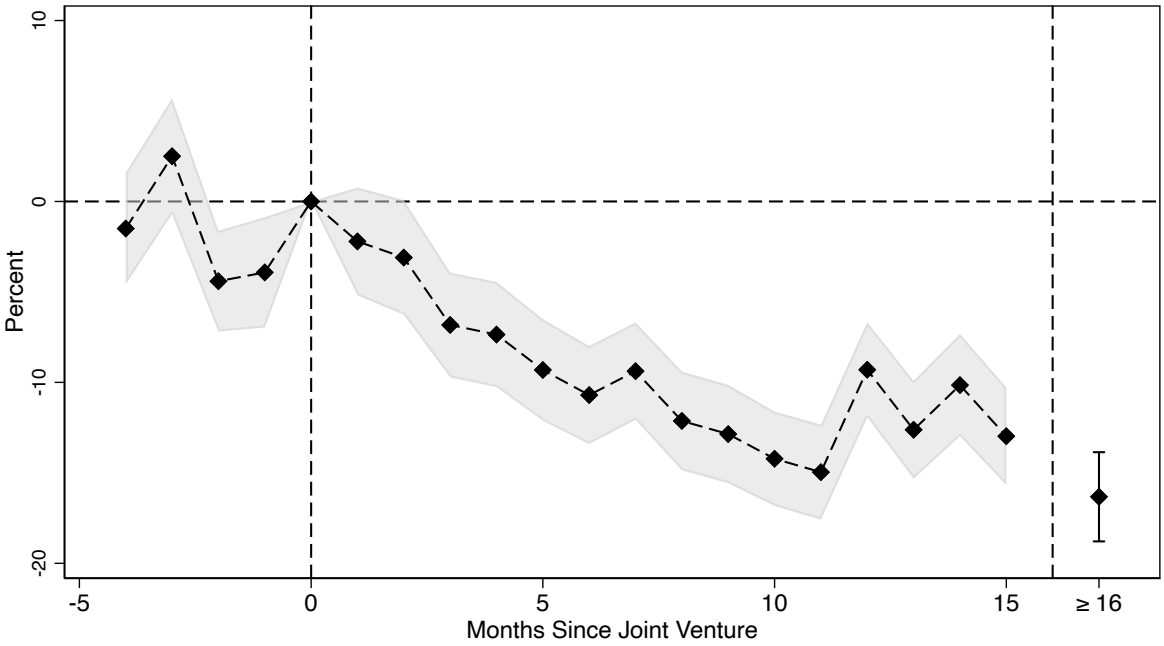
This table provides demographic information about NBI and bank borrowers. Columns (1) and (2) report the shares of NBI and bank borrowers, respectively, who are young, female, or low income. The shares are computed as the number of borrowers in each category, measured in 2015, divided by the number of individuals with an active card, multiplied by 100. Column (3) reports the difference between columns (1) and (2), calculated as NBI minus Bank. Heteroskedasticity-robust standard errors are reported in parentheses. Young borrowers are defined as those below the 10th percentile of the age distribution. Low-income individuals are those in the first income tax bracket, with monthly income below 583,173 pesos as of December 2014 (SII 2014). The lenders involved in the joint venture described in section V are excluded from the calculation.

	Young Borrower				Female Borrower				Low Income Borrower			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$JV\ NBI \times \mathbf{1}\{t \geq 1\}$	-10.59***	-10.60***			-10.82***	-11.32***			-1.27***	-3.35***		
	(0.42)	(0.43)			(0.65)	(0.66)			(0.44)	(0.45)		
$JV\ NBI \times \mathbf{1}\{t \in [-4,-1]\}$			-2.09	-2.15			2.75	2.79			1.42	1.47
			(1.31)	(1.32)			(1.84)	(1.86)			(1.30)	(1.32)
$JV\ NBI \times \mathbf{1}\{t \in [1,5]\}$			-6.02***	-5.79***			-6.65***	-6.72***			-0.76	-1.06
			(1.28)	(1.30)			(1.83)	(1.85)			(1.29)	(1.32)
$JV\ NBI \times \mathbf{1}\{t \in [6,10]\}$			-11.74***	-11.63***			-11.82***	-11.91***			-3.05**	-3.37**
			(1.26)	(1.27)			(1.81)	(1.84)			(1.29)	(1.31)
$JV\ NBI \times \mathbf{1}\{t \in [11,15]\}$			-11.45***	-11.84***			-8.97***	-9.43***			1.46	-0.17
			(1.26)	(1.27)			(1.81)	(1.83)			(1.28)	(1.31)
$JV\ NBI \times \mathbf{1}\{t \geq 16\}$			-14.74***	-14.78***			-7.85***	-8.59***			0.05	-2.62**
			(1.24)	(1.25)			(1.77)	(1.80)			(1.26)	(1.28)
Month Fixed Effects	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
County × Month Fixed Effects	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y
Outcome Mean	7.39	7.70	7.39	7.70	49.97	50.90	49.97	50.90	88.28	90.49	88.28	90.49
Observations	1,444,117	1,343,674	1,444,117	1,343,780	1,444,117	1,343,674	1,444,117	1,343,780	1,444,117	1,343,674	1,444,117	1,343,780
R-squared	0.08	0.10	0.06	0.08	0.01	0.03	0.01	0.02	0.01	0.02	0.01	0.01

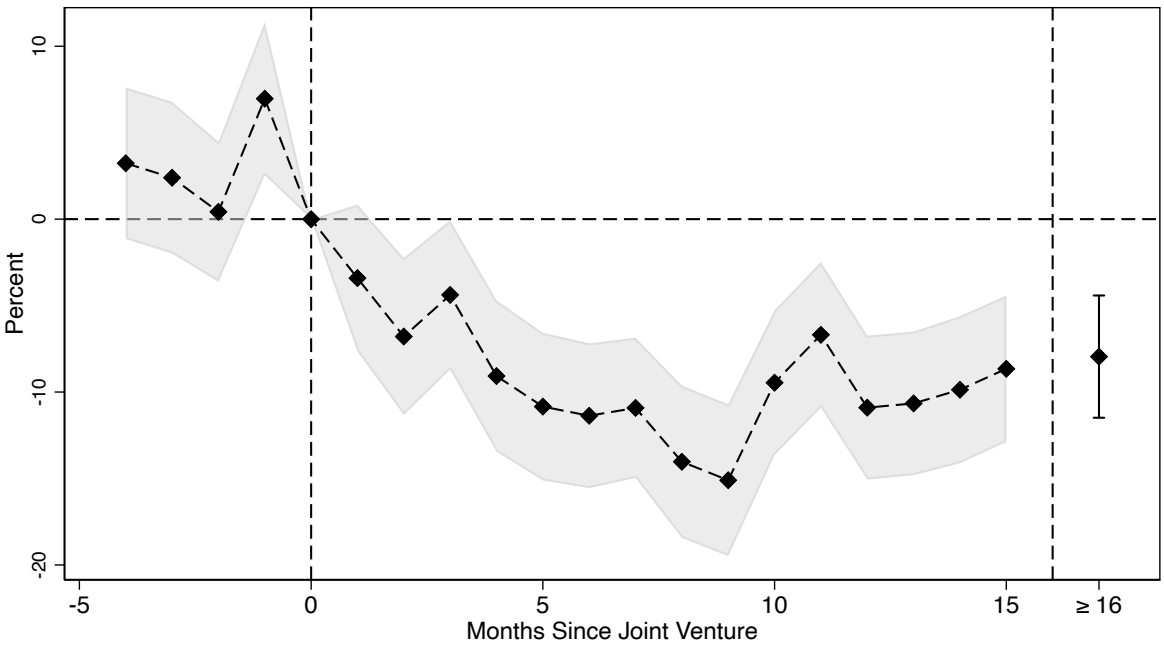
Table VII: Demographics of First-Time Borrowers

This table presents analysis of the demographics of first-time borrowers of the NBI that enters the joint venture described in section V and other NBIs. first-time borrowers are defined as individuals who did not have an NBI or bank card in December 2014 and who hold exactly one card, issued by the JV NBI or by another NBI, in the first month in which they are observed with a card, between January 2015 and December 2017. The dependent variable in the specifications presented in columns 1-4 is a dummy equal to one for young borrowers, defined as those below the 10th percentile of the age distribution, multiplied by 100. The dependent variables in the specifications presented in columns 5-8 and 9-12 are dummies equal to one for female and low-income borrowers, respectively, multiplied by 100. Low-income individuals are those in the first income tax bracket, with monthly income below 583,173 pesos as of December 2014 (SII 2014). JV NBI is a dummy equal to one for borrowers whose first card is issued by the NBI that enters the joint venture. In columns 1, 2, 5, 6, 9, and 10, it is interacted with a dummy equal to one for borrowers who obtain their first card after the transaction ($t \geq 1$). In columns 3, 4, 7, 8, 11, and 12, it is interacted with a set of dummies equal to one for the periods 1-4 months before the transaction and 1-5, 6-10, 11-15, and 16 or more months after the transaction; the month of the transaction, May 2015, is the omitted category. All specifications include issuer fixed effects. The odd numbered columns also include month fixed effects and the even numbered columns also include county × month fixed effects. Standard errors, reported in parentheses, are robust to heteroskedasticity.

Panel A: Young Borrower Dummy



Panel B: Female Borrower Dummy



Panel C: low-income Borrower Dummy

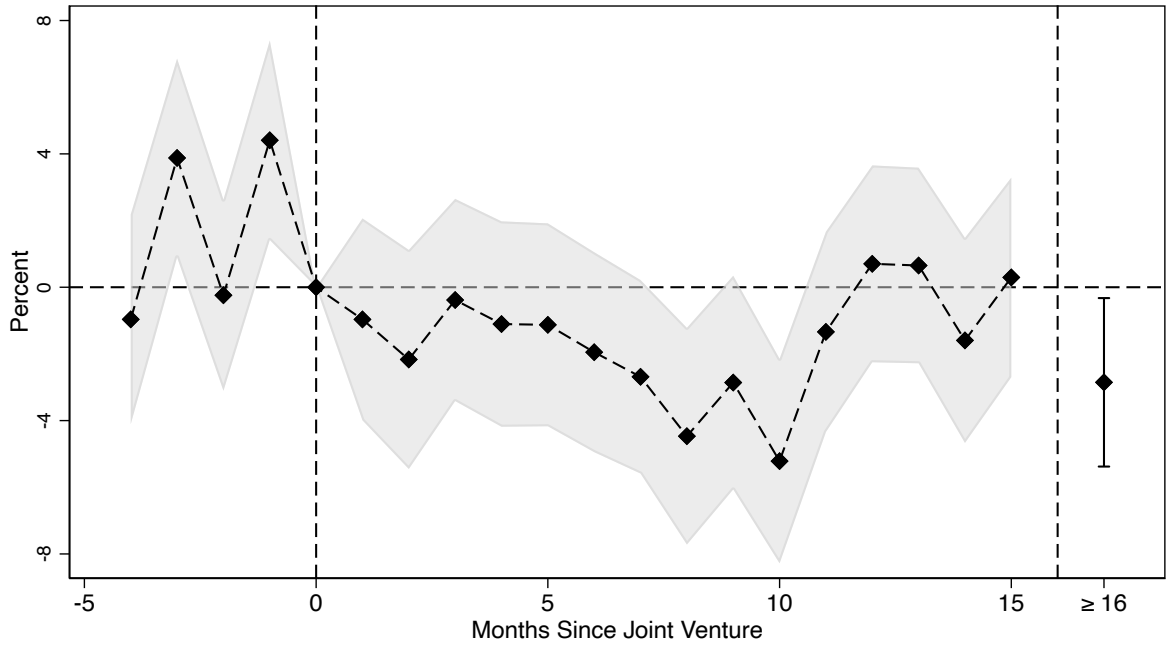


Figure IX: Dynamics of First-Time Borrower Demographics Around the Joint Venture

This figure displays coefficients from specifications explaining the demographics of first-time borrowers of the NBI that enters the joint venture described in section V and other NBIs. First-time borrowers are defined as individuals who did not have an NBI or bank card in December 2014 and who hold exactly one card, issued by the JV NBI or by another NBI, in the first month in which they are observed with a card, between January 2015 and December 2017. Panel A presents coefficients from a specification in which the dependent variable is a dummy equal to one for young borrowers, defined as those below the 10th percentile of the age distribution, multiplied by 100. Panels B and C present coefficients from specifications in which the dependent variables are dummies equal to one for female and low-income borrowers, respectively, multiplied by 100. Low-income individuals are those in the first income tax bracket, with monthly income below 583,173 pesos as of December 2014 (SII 2014). The specifications include a dummy equal to one for individuals whose first card is issued by the NBI that enters the joint venture, interacted with dummies equal to one for each of the 4 months before the transaction, dummies equal to one for each of the 15 months after the transaction, and a dummy equal to one for 16 or more months after the transaction; the month of the transaction, May 2015, is the omitted category. The specifications include issuer fixed effects and county $\times$ month fixed effects. The dark diamonds display the coefficients on the interaction terms. The gray shading displays 95% confidence intervals of the coefficient estimates, and the bar displays the 95% confidence interval for the coefficient on the dummy for 16 or more months after the transaction. Standard errors are robust to heteroskedasticity.

Appendix Tables and Figures

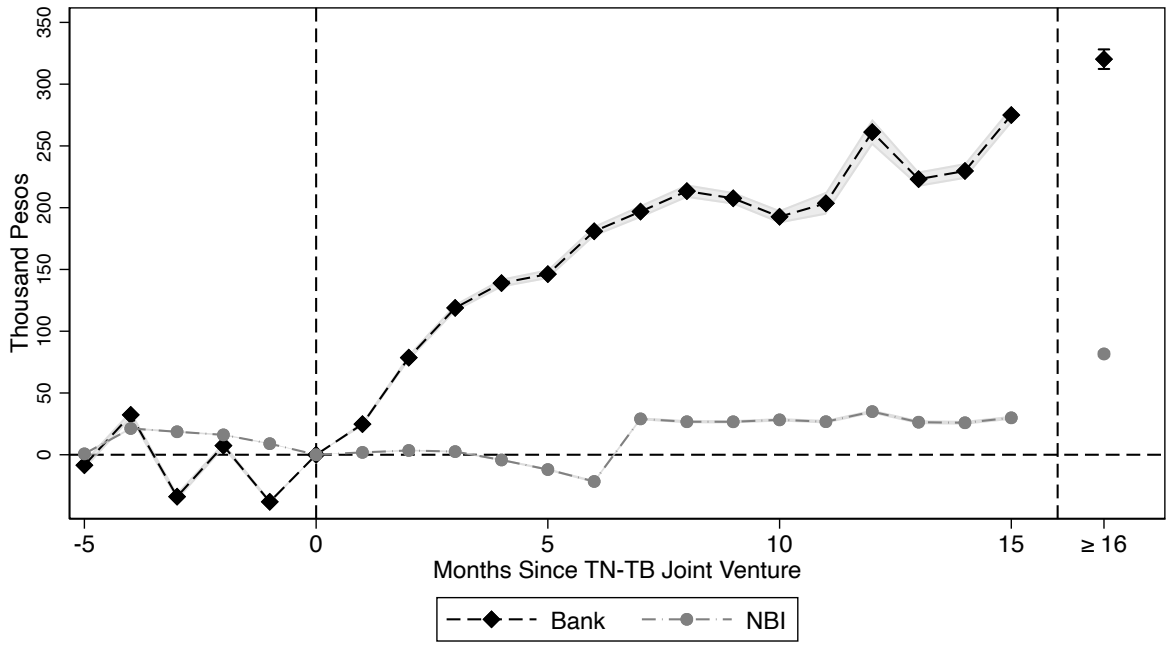


Figure X: Credit Limits Around the Time of the Joint Venture, Month Fixed Effects Specification

This figure displays coefficients from two specifications explaining credit limits around the time of the joint venture described in section V. The specifications are the same as those in Figure VI, except that they include individual and month fixed effects rather than individual and county × month fixed effects. The first specification explains an individual's level of bank credit limits. For individuals with more than one bank card, limits are summed across cards. The specification includes a dummy equal to one for individuals who had a card issued by the NBI that enters a joint venture with a bank in the month of the transaction. This dummy is interacted with dummies equal to one for each of the 5 months before the transaction, dummies equal to one for each of the 15 months after the transaction, and a dummy equal to one for 16 or more months after the transaction. The dark diamonds display the coefficients implied by the interaction terms. The second specification explains an individual's level of credit limits of nonbank issued cards. For individuals with more than one nonbank issued card, limits are summed across cards. The specification is otherwise the same as the first specification, and the light circles display the coefficients implied by the interaction terms. The sample includes all borrowers with a nonbank issued card, including JV NBI cards, at the time of the joint venture. The lenders involved in the joint venture described in section V are excluded from the limit calculations. The gray shading displays 95% confidence intervals of the coefficient estimates. Standard errors are clustered at the borrower level.

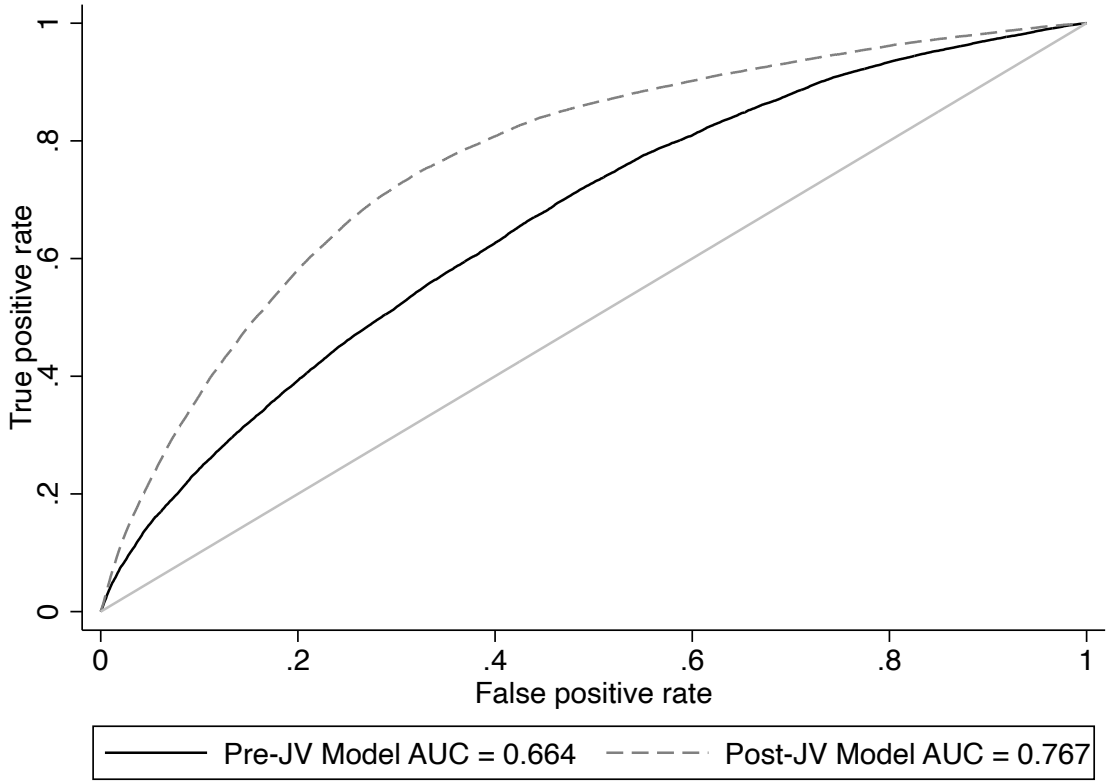


Figure XI: Receiver Operating Characteristic Curves for All Test Borrowers

This figure plots receiver operating characteristic (ROC) curves for two logit models predicting default among borrowers of the NBI that enters the joint venture described in section V. The sample includes all JV NBI borrowers observed in December 2014 with non-missing values of the dependent variable, all predictors, and county. The dependent variable is a dummy equal to one if a borrower is 90 or more days delinquent at any point from January through May 2015, and zero otherwise. The Pre-JV Model includes borrower demographics and bank credit limits and balances. The Post-JV Model adds JV NBI credit limits and balances. Both models include county fixed effects. Young borrowers are defined as those below the 10th percentile of the age distribution. Low-income individuals are those in the first income tax bracket, with monthly income below 583,173 pesos as of December 2014 (SII 2014). Credit limits and balances are measured as of December 2014 in millions of pesos. For individuals with more than one credit card, limits and balances are summed across cards. Borrowers are randomly assigned to a training sample containing 70 percent of borrowers and a test sample containing the remaining 30 percent, with assignment stratified by default status and county. Borrowers in counties whose training sample contains no defaulters or no nondefaulters are excluded. Both models are estimated on the training sample, and the curves are computed from predicted default probabilities for all borrowers in the test sample. Each point on a curve corresponds to a cutoff on predicted default probability above which a borrower is classified as a defaulter. For each cutoff, the curve plots the share of defaulters predicted to default (true positive rate) against the share of nondefaulters predicted to default (false positive rate); moving along the curve from the origin corresponds to lowering the cutoff. The solid black line displays the curve for the Pre-JV Model, and the dashed gray line displays the curve for the Post-JV Model. The light gray 45-degree line corresponds to a model with no predictive content. The legend reports the area under each curve (AUC).