THE RELATIONSHIP DILEMMA:
ORGANIZATIONAL CULTURE AND THE ADOPTION OF
CREDIT SCORING TECHNOLOGY IN INDIAN BANKING

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in Indian Banking
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ABSTRACT

Credit scoring was introduced in India in 2007. We study the pace of its adoption by new private
banks (NPBs) and state-owned or public sector banks (PSBs). NPBs adopt scoring quickly for all
borrowers. PSBs adopt scoring quickly for new borrowers but not for existing borrowers.
Instrumental Variable (IV) estimates and counterfactuals using scores available to but not used by
PSBs indicate that universal adoption would reduce loan delinquencies significantly. Evidence
from old private banks suggests that neither bank size nor government ownership fully explains
adoption patterns. Organizational culture, possibly from formative experiences in sheltered
markets, explains the patterns of technology adoption.

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I. Introduction

What determines whether an organization adopts new technologies or new management practices? Do competitive forces push uniform adoption rates across different types of organizations? We examine these questions using as our setting the introduction of credit scoring technology in retail lending in Indian banking.

In contrast to developed countries such as the U.S. or Europe, where credit bureaus and credit scoring have been around for several decades, credit bureaus obtained legal certitude in India only around 2007 after legislation requiring banks to submit data to bureaus was passed. The act of incorporating credit information from the bureau into a loan decision is a clear marker of the adoption of the credit bureau technology in lending. We examine the differences in the pace of adoption of this new technology across two types of banks, state-owned banks (called public sector banks (PSBs) in India) and "new" private banks (NPBs), relatively modern enterprises licensed after India's 1991 liberalization. For both types of banks, the usage of credit bureaus represents a new and unfamiliar practice. Moreover, the value of adopting this practice is unclear to both types of banks because Indian credit bureaus are subsidiaries of foreign entities, with short operating histories in India.

We analyze adoption using a comprehensive dataset on consumer loans and inquiries that we obtain from a major credit bureau in India. The process for initiating credit inquiries is straightforward. Banks submit an electronic request containing customer biographic and demographic data. The bureau returns a report containing the credit score or a null report if there is no match. Inquiries are a nearly free option for banks; banks pay a nominal fee of $0.15-0.30 per inquiry, which is less than 0.04% of the average loan amount. Since the cost of requesting a score is negligible compared to the expected loss from defaults, and at worst the score can simply be ignored, the scoring technology is worth adopting if at all useful. Using a random sample drawn from the bureau database of loans, repayment histories, and credit scores for over 255 million individuals, we will see that credit scores are informative about credit risk, so scores are useful in lending decisions. With this in mind, we look at the adoption of credit scoring in retail lending decisions in India.

In developed markets such as the U.S., it is routine for banks to check credit scores before granting credit. However, in our sample, this is not the case. Several years after the introduction of credit bureaus, we show that banks make a large number of loans without bureau credit checks, even for customers for whom the bureau holds score data. In particular, there is a significant gap in the use of credit scoring technology between the new private banks (NPBs)

and the state-owned public sector banks (PSBs). NPBs quickly move to inquiring with the credit bureau while PSBs lag behind. The inquiry gap is narrowed somewhat when we correct for differences in focus of activity such as government mandates on priority sector lending to weaker sections. Nevertheless, the inquiry gap is still significant. For instance, in 2015, 88% of all loans by NPBs are preceded by inquiries, double the rate of 44% for PSBs.

Perhaps more interestingly, we find that the gap in bureau usage depends on the type of the customer seeking a loan. For *new* applicants, PSBs are as quick to use credit bureau technology as NPBs. In every year in our sample, PSB usage of bureaus exceeds 95% for new customers. Thus, PSBs are not incapable of, or averse to, using new technology. Instead, PSBs seem to be less willing to use the new technology for existing borrowers with whom they have a prior lending relationship. For these borrowers, we find a significant gap even in 2015, the last year of our sample, in which the bureau usage rate is 48% for PSBs compared to 90% for NPBs. The reluctance to inquire for current borrowers persists close to 7 years after credit bureaus open. However, this gap has narrowed over time.

We consider the possibility that PSBs do not inquire because their clients have no bureau data, and also the possibility that if the score data exists, it has little informational content for PSBs -- because these banks have better information about past credit clients than may be obtained through a credit inquiry. We find little support for either possibility. We find that a large number of clients who are granted loans by PSBs without inquiry have valid credit scores at the time the loan was made. Moreover, the point-in-time credit scores are reliably related to ex-post delinquencies for both NPBs and PSBs. In fact, the relationship is as strong or stronger for PSB customers as for NPBs.

We then obtain point-in-time credit scores for PSB borrowers who were granted loans without inquiry. The scores represent the real time information that PSBs would have seen had they inquired with the bureau for the un-inquired loans. We quantify the information left on the table by estimating the counterfactual loan decisions and the portfolio delinquencies had the PSBs used the neglected credit scores. For a range of plausible counterfactual policy functions on how the additional bureau data would be used if it were obtained, we find that the greater use of credit scores reduces portfolio delinquency by 30 to 40 percent.

It might appear that the slow adoption of the technology, and more specifically, slow adoption for current borrowers, is because of the incentives induced by state ownership of PSBs. While we cannot check this directly, we have a class of privately owned institutions, old private banks (OPBs), which are of similar vintage and went through similar formative experiences as India's public sector banks. However, OPBs were not nationalized in the waves

of nationalization in 1969 and 1980 that created India's public sector banks and thus remain under private ownership. We find that the pattern of adoption by OPBs is similar to that of PSBs rather than of the new private banks. Old private banks adopt credit scoring quickly for new clients but are reluctant to inquire about existing clients. Whatever prompts this behavior, it does not appear therefore to be state ownership. Nor does it appear to be size. OPBs are an order of magnitude smaller than PSBs -- smaller banks do not seem more agile at adopting new management practices.

We conjecture that some persistent aspect of the organizational culture of these older banks might explain the difference in adoption rates from that of the new private banks. The legacy banks grew in an uncompetitive environment in which banks were protected from entry, which diminished profitability concerns and let them go the extra mile for the existing clients. The new private banks emerged in a more competitive era after India's economic liberalization. In the post-reform environment, each transaction had to stand on its own merits. However, it also appears that more intense competitive environment drives out uncompetitive practices over time, which possibly explains why, over time, even the older banks inquire with bureaus more frequently, even for their existing customers. Perhaps competition affects culture-determined behavior, replacing it with more transaction driven behavior (see, for example, Boot (2000), Eccles (1988), or Petersen and Rajan (1995) on relationship versus transaction banking).

The rest of the paper is organized as follows. Section II gives some institutional background regarding the Indian banking system. Section III describe the credit bureau dataset and gives baseline descriptive statistics on the consumer credit market in India. Sections IV establishes the basic empirical facts regarding credit bureau adoption such as the surprisingly common practice of not using credit bureaus for all loans and the reluctance of PSBs to inquire before making loans to existing borrowers. We conduct tests to rule out a number of plausible (and important) empirical explanations for the differential rates of adoption. Sections V and VI present instrumental variable and counterfactual estimates of the information left on the table by not inquiring. Section VII presents results concerning old private banks. Section VIII discusses the implications of our results for research on the adoption of new management practices and new technology and the work on state-owned enterprises. Section IX concludes.

II. Institutional Background

A. Indian Banking Sector

Since independence in 1947, India has had a national banking market in which "scheduled commercial" banks account for virtually all bank assets and liabilities. India's central bank, the Reserve Bank of India (RBI), regulates the Indian banking industry. Entry requires a license which is infrequently granted, so most bank growth has been through expansion of the branch networks of incumbent banks. As of March 2015, the end of our sample period, India had 96 major banks. These banks had 125,672 branch offices, INR 89 trillion (US\$1.4 trillion) of deposits, and INR 65 trillion (US\$1 trillion) in credit outstanding.[2]

State-owned banks (called "public sector banks" in India or PSBs henceforth) include the State Bank of India, which was taken over by the state in 1955 and other banks that were nationalized in two waves in 1969 and 1980. PSBs account for about 71% of credit outstanding. A second category of banks are new private sector banks (henceforth NPBs) that were licensed after India's economic liberalization in 1991. These banks have market shares in deposits and credit of about 21%. India also has old private sector banks (henceforth OPBs), which were entities deemed too small to be nationalized in 1969 and 1980. Our sample excludes 56 small Regional Rural Banks and Local Area Banks serving small town and rural markets, and many small co-operative banks. While over 100 foreign banks are licensed to operate in India, they have small market shares with limited geographical footprints restricted to very large urban areas. They are also not part of our study.

B. Origins of Public Sector Banks and New Private Banks

India's public sector banks have been incorporated for much longer periods than they have been state-owned. For example, India's largest bank, the State Bank of India, was founded as Bank of Calcutta in 1806, and acquired its current name in 1955 when it came under state ownership. Other PSBs are private banks that became state-owned through nationalizations of private banks in 1969 and 1980. The nationalizations reflected India's tilt towards a mixed economic model with extensive central planning and industrial licensing. Nationalized banks were viewed as critical to help achieve plan priorities. Moreover, the formerly private banks

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[2] See https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/T_1010006F0329D7546D4986D609257186816.PDF. The banks collectively employ over a million individuals of which about 830,000 are in the PSBs. INR 65=\$1 around the end of our sample.

were seen as being overly focused on a few corporate entities to the exclusion of new entrants and poorer customers. Nationalization was seen as a way of promoting greater inclusion.

In the 1969 nationalization, the government took over all banks with aggregate deposits exceeding INR 500 million, about 85% of the branch network. In the second round of nationalization in 1980, the government took over banks with nationwide deposits exceeding INR 2 billion, at which point 90% of the banking market was nationalized. After the second round, a number of small banks, the "old private banks" or OPBs, still remained private. After nationalization, personnel of the nationalized banks retained their jobs. However, bank management processes changed significantly. Boards of directors were often staffed with political appointees, and the government's writ extended to nearly all aspects of bank functioning. This included, for example, policies towards personnel such as recruitment, pay, promotion, and job rotation across geographies and functions.

In 1991, a significant economic crisis led the country to liberalize its economy and many of its industrial and trade policies. The country's Banking Act was amended in 1993 to allow new private banks (NPBs) to enter, subject to licensing by the RBI. Some of these NPBs were carved out of former financial institutions engaged in development lending or from non-banking financial companies while others developed organically. The NPBs inherited few operating legacies, and typically started with a relatively blank slate while formulating their operational procedures and growth strategies.[3] They had the normal problems of new entrants in a market surrounded by incumbents, though economic growth also picked up in the post-reform era, giving them room to expand.

C. Technology Adoption by Indian Banks

The benefits of computerizing operations were recognized by all banks as early as the 1990s. However, PSB adoption of technology was slow due to union fears of job losses (Rishi and Saxena, 2004).[4] After pressure from central bank committees (Rangarajan Committee, 1989; Narasimhan Committee, 1991), from customers used to better service at the new private banks, and from interoperability issues in areas such as clearing, PSB unions signed modernization agreements in October 1993 and March 1997. Nevertheless, adoption remained slow. In 2001, only 9,777 out of 46,426 branches of PSBs had been computerized.

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[3] See Bandopadhyay, T., 2012, "A Bank For the Buck." Jaico Publishing for an account of HDFC, one such bank.
[4] These concerns about job losses from automation are the in the modern debate over AI. See, e.g., the address by the famous investor Warren Buffett at https://finance.yahoo.com/news/warren-buffett-ai-good-society-enormously-disruptive-203957098.html

An entirely different path towards technology was followed by the new private banks (NPBs) that entered after India's post-1991 economic liberalization. The NPBs faced a liberalizing banking environment that allowed them to operate without the burdens of legacy institutional, human, and regulatory constraints. For example, requirements that banks open 4 branches in underserved areas for every ordinary branch were relaxed and commercial viability introduced as a criteria for branch expansion (Burgess and Pande, 2005).[5] Moreover, NPBs did not have the physical branch infrastructure that the nationalized banks had, so communications and information technology like ATMs were necessary for their rapid growth. Thus, NPBs were open to, and adopted, technology in all aspects of banking, not just backroom operations. They emerged as relatively modern enterprises within a decade after their birth. Their technology intensive operations are reflected in their aggregate operating ratios even at early stages in their existence. For instance, in 2001, the average revenue per employee for NPBs was INR 75 million, about 5 times the INR 13-16 million for PSBs.

D. Establishment of Credit Bureaus in India

In the U.S, three national credit bureaus, Equifax, Experian, and Transunion, hold vast repositories of credit data and have long histories of operation (Avery, Calem, and Canner, 2003).[6] These bureaus now track consumer spending, repayment histories, identity information, and over time, have added data such as court records. The *Getting Credit* section of the World Bank Doing Business section shows that information sharing arrangements such as credit bureaus are common in European countries but less so in developing countries (Djankov, McLeish, and Shleifer, 2007).[7]

In India, bureaus have more limited operating histories. The oldest bureau in India, Transunion CIBIL, was established in 2000 and began as a fledgling consumer bureau service with 4 million records in 2004. Enabling legislation was finally passed as the 2005 Credit Information Companies (Regulation) Act, or CICRA and went into effect on December 14, 2007. The Act requires financial institutions to submit lending and repayment data to bureaus. As a result, the bureaus have been able to expand their operations significantly. For example, as of March 2015, the database at Transunion CIBIL has about 472 million records for over 255 million individuals. Besides Transunion CIBIL, three other bureaus, Experian, Equifax

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[5] See, for instance, https://www.rbi.org.in/upload/notification/pdfs/55197.pdf
[6] Equifax traces its origin to a single shop set up in 1899 and assumed its current name in 1979. Experian was formerly TRW as part of an engineering and electronics company. It has been in operation since the 1960s and assumed its current name in 1996. Transunion's history in consumer credit dates back to 1969.
[7] See http://www.doingbusiness.org/data/exploretopics/getting-credit

(both owned by U.S. parents) and CRIF-Highmark (owned by an Italian parent), have been licensed to operate in India.

E. Bank Use of Credit Bureaus

Current regulations require lenders to submit data on new loans and repayments of existing loans to bureaus. The bureaus compile and standardize lending data, develop analytical insights into delinquencies, and assign scores. The Indian market poses unique challenges to the bureaus. Primary among these is financial exclusion. Large segments of India's population simply do not access the formal financial system for credit and do not have ways to build credit histories (Agarwal et al., 2017). Moreover, legacy systems for identification feature multiple permitted identity documents. Many are paper-based and hand-written, vary in the fields that are collected and the languages they are printed or written in. Establishing a person's identity and attributing data to that person has not been easy, but the credit bureaus have tried-and-tested algorithms for doing so. India has since moved to a single biometric based unique identity card, the "Aadhaar" card. However, these data are not integrated into credit databases and face legal challenges on the permissible end-uses even today.

Given operational challenges on issues such as establishing clear customer identity, bank managers may well be skeptical about the benefits of bureaus. Moreover, regulations do not say whether or how banks should use the data in their lending process. Banks vary in the extent to which they use bureaus, as we will show shortly. The variation in bureau usage and the limited use of bureaus are also important policy concerns. For example, a committee formed by India's central bank, the Aditya Puri committee, noted in 2014 that it is standard practice for all banks to reference credit bureaus prior to lending but there was little empirical evidence on the benefits of doing so. The committee recommended further study on this issue.[8]

III. Data and Baseline Descriptive Statistics

A. Credit Bureaus

Financial institutions submit monthly data on all new loans granted and repayment to credit bureaus. The bureaus record these submissions and extensively cross-check submissions for integrity. For a nominal fee, currently $0.15-0.30, these institutions can inquire with

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[8] See https://rbidocs.rbi.org.in/rdocs/PublicationReport/Pdfs/APR220314FS.pdf, March 22, 2014. The circulars pertaining to credit bureau usage include DBOD.No.BC.DL.(W)12/20.16.002(1) 98-99; DBOD No. DL. BC. 111/20.16.001/2001-02, Submission of credit information to CIB. June 4, 2002; RPCD.CO RRB.No. 32/03.05.33/2009-10, CIC (Removal of Difficulties) Order, 2008, October 20, 2009;

Transunion CIBIL about new applicants for credit. The bureau records these inquiries. Our data are a random and anonymized subset of the loan and inquiry data from Transunion CIBIL, which is India's oldest bureau.

Once a bank makes an inquiry, the bureau cross-checks member identities through de-duplication algorithms that account for variations in names and their representation from India's 22 official languages and the nature of identity documents. A match is returned only when the degree of agreement based on 10 fields such as name, age, address, zip codes, phone numbers, and family members staying in the same dwelling exceeds a threshold. If individuals cannot be matched reliably, the bureau returns a null credit report. If a match is found, the bureau returns a point-in-time credit score and a brief report.

B. Our Random Sample

Our sample period ends in fiscal 2015, i.e., March 2015. As of this date, Transunion CIBIL covers 1,840 member financial institutions and 255 million individuals who have 472 million loan records.[9] The bureau started with the universe of all individuals covered and extracted a 1% sample at random, which was anonymized and provided to us for analysis on site. Any individual in the random sample is retained for all the analysis regardless of whether the individual had only inquiries, loans without inquiries, or loan granted after inquiries. We adopt the bureau terminology of labeling each individual as a unique "FID."

C. Inquiry and Trade Files

The credit bureau data are organized into 3 files. The *address* file contains demographic data from which we obtain the age and gender of the applicant. The *inquiry* file records all inquiries made by member financial institutions with the bureau. There are two types of inquiries. Active inquiries are for the purpose of potentially extending credit to borrowers. Passive inquiries are for routine risk management purposes for existing accounts rather than for granting credit. Our sample includes only the former. We do not know the type of loan for which there is an inquiry since banks do not report this while inquiring. The third data file is the *trade* file, which includes records of all new credit granted. This dataset includes an indicator for the type of loan made such as agricultural or automobile loans.[10] For each credit

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[9] The credit registry dataset is proprietary and not publicly available. We have no access to fields such as the names of the individuals and banks, or their exact addresses, in these files. The bureau requires all analysis to be performed on site with no remote access.

[10] Credit cards are not a significant source of credit in India and most activity in this area in our sample period is due to foreign banks in metropolitan areas. For instance, as of September 2016, consumer lending accounts for

facility, the trade file includes the loan amount granted and an indicator for whether the repayment is delayed.

The bureau data are complete for recent loans but older loan data are populated only on a best efforts basis because of substantial variations in the computerization and accuracy of older bank records. However, CIBIL has been in existence from 2000, so these issues should be relatively small for the regression analysis, which focuses on data after 2013.

E. Growth in India's Consumer Lending Market

The Indian consumer credit market has been booming. Central bank statistics show that as of fiscal year ending March 31, 2016, total bank credit outstanding in India was INR 78.9 trillion (US\$ 1.2 trillion), or around 60% of India's GDP of US\$ 2 trillion. 28.7% of total bank credit is consumer credit. Consumer credit excluding agriculture is INR 13.9 trillion, or 17.63% of total bank credit, and is growing rapidly at 15.8% per year.[11] Between 2015 and 2016, the aggregate number of borrowers increased by 18.6% and is likely to grow even more significantly as India remedies the high level of financial exclusion (Demirguc-Kunt, Klapper, Singer, and van Oudhusen, 2015) through its "PMJDY" program that has brought in more than 300 million individuals into the banking system between 2014 and 2016 (Agarwal, Alok, Ghosh, Ghosh, and Seru, 2017; Chopra, Prabhala, and Tantri, 2017).

We see similar growth in lending in the credit bureau statistics on inquiries and loans in Table 1. Consider an applicant who walks into a bank seeking a loan. The loan could be rejected summarily without further processing. If the bank decides to move forward, it could inquire from the credit bureau, or it could make a loan without an inquiry. We define an inquired loan, that is, a loan preceded by inquiry, as a loan made by an institution to an individual for which the institution made an inquiry at the credit bureau within a 180-day window prior to the loan. A loan without inquiry is one where there was no such inquiry. While we do not have data on applications that are summarily rejected, we do know the total number of inquiries made by a bank and the loans made without inquiry. We call the sum of the number of inquiries and loans without inquiry as *filtered applications*. It is a proxy for applications but after any applications summarily rejected by banks without inquiry are filtered out.

19.34% of total bank credit while cards comprise 0.70%. As of December 2017, there are 36 million credit cards outstanding in India compared to 847 million debit cards (htpps://dbie.rbi.org.in)

[11] See RBI's database on the Indian Economy (https://dbie.rbi.org.in). For comparison, in 2016, the total consumer credit in the U.S. excluding real estate is \$3.6 trillion, which is about 20% of GDP. Mortgage credit adds about \$11 trillion, or another 60% of U.S. GDP. Source: FRB Release G.19.

In Table 1, we report annual aggregates on filtered applications, inquiries, and loans for our 1% subsample. "Year" denotes the fiscal year ending on March 31, which is the financial year end for all banks in our sample and for almost all Indian corporations. Between 2006 and 2015, the 1% sample contains 4.33 million filtered applications and 2.97 million loans, of which 2.29 million loans are made without inquiry and 0.68 million loans are made after inquiry. The total amount of new loans is INR 896 billion or about US$ 13.78 billion at $1 = INR 65. As Table 1 represents a 1% sample, the aggregate volume of new loans in the bureau data is $1.4 trillion.

The data in Table 1 show that India's consumer lending market is booming. In 2006, the 1% sample contains 178,032 loans for an aggregate amount of INR 38.87 billion. In 2015, there are 579,000 loans for an aggregate amount of INR 177 billion. Between 2006 and 2015, the number of new loans granted increases at 15.2% per year. The growth in the amount disbursed is even more impressive and is close to 20% per year. The growth reflects both the consumer credit boom in India and also the better coverage of credit by bureaus as reporting technologies become better integrated into the banking system.[12]

The data in Table 1 also show that bureau usage increases over time. The number of inquired loans in the 1% sample (column 4) goes up 30-fold from 5,150 in 2006 to 177,439, and inquired loan amounts (column 7) increase by about 40 times from INR 2.95 billion to INR 114.64 billion. The share of the overall loan amount inquired, reported in column 10, increases from 7.60% in 2006 to 64.51% in 2015. However, over one-third of the amount -- and close to 71% of the number -- of new loans are made without a credit bureau inquiry, 8 years after bureaus were legally enabled in India.

IV. Bureau Usage by Banks

In Table 2, we partition the data into loans made by New Private Banks (NPBs) and state-owned or Public Sector Banks (PSBs) that are majority owned by the central government. Inquiries are systematically lower for PSBs compared to NPBs in every year of the sample. In the final year of our sample, 2015, the data in Panel A of Table 2 indicate that PSBs inquire for only 11.67% of the number and 41.38% of the amount versus 67.31% and 85.19%, respectively, for NPBs. As an alternative metric, we define the variable "bureau usage" as the number of inquiries divided by the number of filtered applications. Usage is thus the proportion

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[12] It is not possible to get a precise decomposition of the two components. The bureau data reflect the flow of new loans granted while the official RBI statistics are based on the stock of loans outstanding. That a good portion of the bureau statistics reflects real lending growth is clear from the RBI Basic Statistical Returns, in which the number of consumer and agriculture loan accounts increase by 63% from 65.29 million to 106.29 million while the corresponding loan amount more than doubles from INR 5.27 trillion to INR 11.4 trillion.

of the filtered applicant pool that is inquired. In 2015, the last column of Table 2 indicates that bureau usage is 27.12% for PSBs versus 85.43% for NPBs, which is about a 50 percentage point gap in bureau usage between the two banks.

There could be a variety of natural explanations for why PSBs use bureaus less that have nothing to do with their organizational traits. Three explanations come immediately to mind: a) PSBs make different kinds of loans. For instance, they may have greater numbers of government-mandated loans in which they have less flexibility in using credit scores to inform lending; b) PSB clientele are unlikely to be tracked by the credit bureaus; c) Bureau information is irrelevant for PSBs, for instance because the internal information held by PSBs is special and bureau data are not incrementally informative. We explore these possibilities next.

A. Priority Sector and Gold Loans

Government mandates require Indian banks to lend a certain fraction of their portfolio to entities such as farmers and the poor that are traditionally cut off from the formal credit market (Banerjee, Cole, and Duflo, 2005; Burgess, Pande, and Wong, 2005). Such loans are called priority sector loans. PSBs may be more likely than NPBs to meet these statutory obligations with small ticket loans to farmers and financially excluded individuals who are less likely to have credit data captured by bureaus. Even if banks conduct credit checks for such borrowers, they may not have much ability to alter credit decisions based on scores, which may be one reason why PSBs have low inquiry rates.

A second source of variation in inquiries is lending against gold collateral, or gold loans. PSBs may make more gold loans than NPBs. These loans may be less inquired because they are safer; regulations require significant haircuts on gold collateral. Moreover, gold has a special place in Indian culture as a means of saving and making intergenerational wealth transfers.[13] Given a borrower's attachment to pledged gold and the over-collateralization of gold loans, these loans may also have low rates of inquiry. We thus reconsider inquiry and lending data after excluding gold loans and priority sector loans

The credit bureau dataset flags both priority sector and gold loans. Both types of loans are indeed more common for PSBs. Over our sample period, 84.5% of the gold loans and 98.6% of the priority sector consumer loan originations are by PSBs.[14] Both categories of loans also

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[13] See http://www.gold.org/supply-and-demand/gold-demand-trends, accessed September 2015. India's 2015 gold consumption is 668.5 tons, 27% of the world demand, compared to its 6-7% share of World GDP.
[14] Discussions with the credit bureau indicate that priority sector loans include agricultural loans and loans to micro enterprises.

have low inquiry rates. For instance, only 1.80% of the sample of priority sector loans and 2.88% of gold loans were preceded by a bureau inquiry. We exclude both priority sector and gold loans from further analysis.[15]

B. Final Sample After Excluding Gold and Priority Sector Loans

The remaining consumer loans in our 1% sample are housing loans, automobile loans, and other retail consumer loans. It is reasonable to expect credit bureaus to be helpful for all three categories of loan decisions. Retail consumer loans without collateral require diligence in assessing borrower repayment capacity. However, in India, even collateralized loans are dependent on the borrower's repayment capacity because of difficulties in collateral enforcement (Visaria, 2009; Vig, 2013). Banks can begin procedures only after 90 days of non-payment, after which they must serve a notice period of 60 days, and another notice period of 30 days before repossession is initiated. Actions can be appealed and courts are so clogged that even fast track courts with mandates to clear cases in 90 days can take years to arrive at decisions.

In Table 3, we present inquiry and lending data for the final consumer loan sample. We partition the data into loans for new borrowers and prior relationship borrowers in Tables 3A and 3B, respectively. Both NPBs and PSBs have limited information about new customers. However, for existing customers, banks do have some prior data on them. For instance, loan officers can rely on repayment histories, checking account activity, and other data that come from customer-bank interactions. Banks typically have procedures to gather and use these internal data, likely ingrained in its loan officers through internal training. The more accepted such procedures, the less likely are banks to be receptive to outside data to inform lending for existing customers.

In Table 3A, we find that usage is lower for PSBs when a borrower has a prior lending relationship with the bank. Even in 2015, towards the end of our sample period, Table 3A shows that the bureau usage rate is only 48% for PSBs (Panel A), compared to 90% for NPBs (Panel B), representing a 42% gap. In sharp contrast, Table 3B shows that for customers with no prior relationship with the inquiring bank, there is a relatively minor difference in bureau usage rates between PSBs (98.5%) and NPBs (99.7%).

We also note in Table 3B that PSB usage of bureaus for new customers is above 98% right

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[15] We note a small bias here. We exclude priority sector and gold loans but some inquiries remaining in our sample may pertain to these types of loans. Given that less than 2% of agricultural loans are inquired and less than 3% of gold loans are inquired, the bias will be small. The adjustment of the base bureau usage rates for these differences is minor.

from 2006. Thus, PSBs adopt the credit bureau technology almost fully right from inception for new borrowers. The low bureau usage by PSBs for customers with prior relationships is not driven by aversion to new technology or ignorance of it. Instead, PSBs seem relatively unwilling to inquire for customers with prior relationships even as they embrace the practice of inquiring with bureaus for nearly all new borrowers. This asymmetry is the focus of our investigation.

D. Bureau Usage Classified by Credit Score Buckets and Credit Score Availability

One explanation for low bureau usage by PSBs is that fewer of their customers have bureau records. Anticipating this, especially of prior relationship clients, they may inquire less. We already reduce this possibility by eliminating priority sector and gold loans. We test this point directly for the remaining loans by examining score data, which the bureau provides us for fiscal years 2013 and 2014. The credit scores are historical "point in time" numbers that were available to banks in real time when inquiries or loans were made.

In Table 4, we classify filtered applications for both PSBs and NPBs by whether credit scores are available and when scores are available, by credit score bucket. For inquired loans, the credit scores are what the banks who inquire see. For un-inquired loans, the scores are what the banks would have seen had they inquired. In India, scores of 750 or above are considered excellent, those between 650 and 750 are good, and scores below 650 are fair to poor.[16] We divide the score data for loans and inquiries in Table 4 into these three buckets.

For new borrowers, Panel A in Table 4 shows that bureau usage is almost complete across credit score buckets for both PSBs and NPBs. We find that PSB bureau usage rates equal 98.80%, 98.24%, and 98.33% for borrowers in the low, medium, and high credit score buckets. For NPBs, the corresponding usage rates equal 99.61%, 99.36%, and 99.58%, respectively. Panel B in Table 5 shows that there is more variation across credit score buckets for customers with existing bank relationships, and this varies further between PSBs and NPBs. We see a "U"-shape in inquiry patterns for PSBs. The most inquired are the low quality credits (65.41%), the least inquired are the medium quality credits with scores between 650 and 750, for which the inquiry rate is 54.54%, after which inquiry rates climb once again to 62.75% for high quality credits. The inquiry patterns for NPBs are greater and flatter across credit score buckets (97.61%, 96.51%, and 97.08% respectively).

In Panel A of Figure 1, we plot the kernel-smoothed fraction of loans inquired against credit

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[16] See, e.g., https://www.bankbazaar.com/cibil/cibil-credit-score.html.

scores. The curve for PSBs shows a similar dip as Table 5 at the middle score levels and then a positive slope for high score applicants. We will suggest an interpretation of this pattern later.

In Panel B of Figure 1, we plot the fraction of loan amounts applied for that are inquired at each credit score. While the dip in the middle noted in Panel A is no longer perceptible, we find that, as before, PSBs appear to inquire more for *higher* quality credits than for lower quality credits.

The relationship between scores and inquiry is relatively flat for NPBs in Panel A and Panel B of Figure 1, with a slight dip for particularly high quality credits in Panel B suggesting that NPBs, unlike PSBs, are slightly *less* likely to inquire for better credits.

The asymmetry in bureau usage for PSBs and NPBs for their customers with and without prior relationships exists even within the universe of unscored customers. Between PSBs and NPBs, there is a relatively small difference in the fraction of the new borrower applicant pool that is scored. For example, Table 4 Panel A indicates that 60,909 of the 94,730 filtered applicants, or 64%, of PSB applicants have no credit scores compared to 95,249 out of 136,550, or 69%, for NPBs. For clients with existing loan relationships, Panel B indicates 57% of PSB applicants have no scores versus 41% for NPBs. These figures still do not explain the difference in bureau usage rates between PSBs and NPBs. For example, within the pool of prior relationship applicants, the bureau usage rates (the percentage of filtered applications subject to inquiry) is lower for PSBs compared to NPBs both for scored applications (58.20% versus 96.88%) and for unscored applicants and (14.39% versus 64.35%). Interestingly, these figures suggest bureau usage falls both for NPBs and PSBs for unscored customers relative to scored customers – suggesting all banks have some sense of which customers are likely to have bureau scores.

E. Chances of Getting a Loan

Let us turn now from inquiry to the chances of getting a loan. First let us look at loan granting rates, conditional on inquiry, or P (L|I), which we reported in the last but one column in Table 4. We compare this data for customers with no prior relationship between PSBs and NPBs. We find that PSBs grant fewer loans per inquiry than NPBs – to those with low scores (7.42% vs 9.69%), medium scores (15.61% vs 28.43%), or high credit scores (16.67% vs 28.04%), and even to those with no scores (27.54% vs 38.23%). In general, conditional on inquiry, the decisions of PSBs are notably more stringent than for NPBs for customers with no prior relationships. As we will see, this is also reflected in ex post default outcomes.

Turning to customers with prior relationships, the results in Table 4 show that both PSBs

and NPBs seem to be (naturally) more willing to grant credit conditional on inquiry to clients they have a prior relationship with than with clients that they have no experience about. In Table 4 Panel B, we find that PSBs are again less likely to grant loans conditional on inquiry than NPBs, i.e., have lower P (L|I) for anyone who is scored. These fraction of inquiries granted for PSBs and NPBs are 15.40% versus 17.80% for those with low scores, 23.54% versus 37.01% for borrowers with medium scores, and 23.49% versus 36.81% for borrowers with high credit scores, respectively. However, this pattern reverses for unscored clients, where PSBs are relatively more inclined to grant loans conditional on inquiry compared to NPBs (58.67% vs 21.91%).

In sum, conditional on inquiry, PSBs seem to be less willing to grant credit than NPBs, except when they have a prior relationship with the client and the inquiry returns no score, when they seem much more willing to grant credit.

How about the total probability of getting a loan for anyone submitting a filtered application for a loan? This is computed in the last column in Table 4 as the ratio of the loans with inquiry plus loans without inquiry divided by the number of filtered applications. Panel A shows that for clients with no prior relationships, since PSBs and NPBs inquire almost all applications, the percentage of filtered applications that culminate in a loan is very close to the fraction of inquiries that culminate in a loan.

More interesting are the figures for loans granted to customers with prior relationships. We see that 44.67% of applications from low score customers with a prior relationship with a PSB are granted loans compared to 19.76% for NPBs. The fraction of low credit score applicants getting a loan from PSBs is more than double that from an NPB. For medium score clients the numbers are 58.30% vs 39.21%, for high score clients it is 51.99% vs 38.67%. For unscored clients, it is an astounding 94.05% vs 49.74% or double the fraction for PSBs compared to NPBs. Even though the PSBs are more circumspect in granting credit for loans they inquire (except for loans that return no score), they also make many loans without inquiring for existing clients. So the loans per filtered application are much higher.

In sum, the bureau usage practices of PSBs relative to NPBs tilt their credit portfolios towards un-inquired credits and those with lower credit scores, but primarily for those with prior relationships.

F. Are Credit Scores Not Useful? Evidence from Delinquency Rates

Credit scores are useful in markets such as the United States for predicting delinquency (e.g., Gross and Souleles, 2002; Agarwal and Hauswald, 2010). Whether they are useful in

India is less clear because the credit bureaus have limited histories of operation in India. Perhaps PSBs believe that credit scores are uninformative about delinquency relative to the internal information they hold or the institutional knowledge they may have from several decades of operation in India. We now test this hypothesis by examining the relation between ex-ante credit scores and ex-post delinquency rates. After checking this, we ask whether PSBs have no need of the information contained in credit scores, especially for prior relationship borrowers who are less likely to be inquired.

F1. Delinquency Rates and Credit Scores: Data and Definitions

The credit bureau provides us loan repayment histories and credit scores for a limited period of 36 months going back from September 2015. Repayment histories for loans made prior to September 2012 are incompletely populated, so we restrict our analysis on delinquencies to accounts opened in or after September 2012. We identify delinquent accounts using a field called "days past due" (DPD), which is the number of days a borrower is late on payments. This field is reported monthly because consumer loans in India are repaid through equated monthly installments. A practical issue in India is that a positive but small DPD may reflect transactional glitches such as delays in processing or bank errors rather than credit deficiencies. To rule out such cases, we define a loan as being delinquent if the days past due is at least 90 days, which corresponds to the definition of non-performing asset used by India's banking system.[17] The variable LQ360 equals 1 if at least one of the available DPDs during the 360 days from opening the account exceeds 90 days. By focusing on delinquencies that occur soon after the loan is given, we minimize the extent to which exogenous unanticipated macroeconomic events subsequent to the granting of the loan affect delinquency rates.

A loan is made after a financial institution uses both the information it has, and the information available with the credit bureau (if the loan is inquired). If lenders use additional private information for screening out applicants with higher true delinquency risk for a given score, the measured rate of delinquency associated with any credit score should be lower than if loans were randomly drawn from the population. Put differently, a loan made using greater bank knowledge about the borrower should have lower delinquency rates, conditional on the publicly available credit score, than a loan made using no bank-specific information. The difference between the two will be small when the amount of bank private information is lower.

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[17] See https://rbi.org.in/scripts/BS_ViewMasCirculardetails.aspx?id=7357#21

F2. Delinquency Rates and Credit Scores: Empirical Results

Table 5 reports delinquency rates by credit score buckets. Credit scores predict ex-post delinquency in our dataset. For instance, the data in Panel A show that the delinquency rate in the low score bucket across all banks is 3.14% compared to 0.77% and 0.30% for the medium and high score buckets, respectively. The difference between the delinquency rates in different score buckets is significant. The *t*-statistic is 9.8 for the difference in delinquency rates between low and medium score, and 7.3 for the corresponding difference between medium and high score buckets. We see a similar downward sloped relation between scores and delinquency rates individually for both public sector and private banks.

Figure 2 depicts this relationship visually. In Panel A, we find that delinquency as measured by LQ360 is greater when scores are lower. In Panel B of Figure 2, we find that PSBs do not seem to have lower delinquency rates conditional on credit scores compared to NPBs, as also suggested by Panel A of Table 5. The overall delinquency rate for the low score, medium score, and high score buckets are 4.15%, 0.78%, and 0.34%, respectively, for PSBs, while it is 2.14%, 0.76%, and 0.25% for the corresponding buckets for NPBs. Regression results reported later substantiate this finding. However, as we will see shortly, the difference is entirely driven by loans with prior relationships. For new loans, the PSBs experience lower defaults in each credit category.

Equally interesting is to look across rows in Table 5. The act of inquiring is associated with lower default rates, regardless of whether loans are scored or not, regardless of bank type or the existence of prior relationship. For example, in Panel A, scored loans for PSBs have delinquency rates of 1.29% when loans are made without inquiry compared to 0.51% when loans are made after inquiry. For NPBs, the corresponding numbers are 2.90% and 0.64%. The finding that inquiries are associated with lower defaults might indicate a complementarity between the bank's private borrower-specific information and the information obtained from the credit bureau upon inquiry, which allows for a better decision to be made than with either piece of information alone.

A not-mutually-exclusive possibility is that loans made without inquiry are especially risky because the act of not inquiring conveys information about the care with which the loan officer undertakes due diligence. Indeed, inquiries are associated with lower delinquency rates even for unscored loans. For example, in Panel A of Table 5, we find delinquency rate for unscored loans, where the credit bureau does not have much information, is 1.95% for un-inquired PSB loans compared to 0.78% for inquired loans, and 2.89% for un-inquired NPB loans compared to 1.43% for inquired loans. That the rates of default are lower for inquired loans relative to

un-inquired loans even in the unscored population suggests that the act of not inquiring, a decision made by the loan officer, conveys information about the due diligence exercised on the loan. The reduction in delinquencies from inquiring is not solely due to information obtained by the bank from the bureau.

There is more of interest in Table 5 concerning the information in prior borrowing relationships. For unscored loans where the bank has a prior relationship (Panel B), the delinquency rate is 1.12 percent for PSBs and 0.81 percent for NPBs, while for unscored loans with no prior relationship (Panel C), the delinquency rate is 0.85 percent and 1.69 percent respectively. Put differently, prior relationships tend to lower the quality of PSB loan decisions, while it enhances the quality of NPB decisions, even in cases where the credit bureau adds little information.

This finding carries over to scored loans. For loans made by NPBs to the scored subsample, the delinquency rate is lower for prior relationship borrowers compared to new borrowers. For instance, the NPB delinquency rates for the low, medium, and high score buckets when lending to prior relationships (Panel B) are 1.30%, 0.51%, and 0.19%, respectively, and 3.76%, 1.16%, and 0.36%, respectively, for loans with no prior relationship (Panel C). So NPBs do seem to acquire some information from prior relationships that helps them discriminate better.

On the other hand, for PSBs, delinquency rates are greater for prior relationships even conditional on credit scores. From Panel B, the delinquency rates for the low, medium, and high score buckets for loans with prior relationships are 4.83%, 0.82%, and 0.38%, respectively, while the rates are 2.70%, 0.65%, and 0.27%, respectively, for loans with no prior relationship. This result suggests that the irrelevance of credit bureau data is unlikely to explain the inward orientation of PSBs, or their reluctance to look at market data for prior relationship borrowers. That PSB loan officers are not more lax than NPB loan officers for some regulatory or technological reason can be seen in delinquency rates for loans with no prior relationships. As Panel C suggests, across all categories, scored or unscored, PSBs have lower default rates than NPBs.

In sum, it appears that it is *not* necessarily just the complementarity of borrower-related information held by the bank and borrower-related information with the bureaus that makes inquired loans less risky. Rather, the act of not inquiring conveys information. Non-inquiry could reflect active intent or passive attitudes of the loan officer. For instance, if the loan officer is friendly with a client (or the client is her nephew), she may not want to inquire if she believes the client will be particularly risky given observable risk characteristics. Indeed, since the act of not inquiring indicates a willingness to forego ordinary due diligence, this sort of agency

problem in selecting who is inquired could result in un-inquired loans being riskier, even conditional on underlying credit score, than inquired loans.

An alternative explanation may be that loan officers may simply be lazy, and the act of non-inquiry suggests the loan officer may be lax on other aspects of due diligence such as income verification. However, if PSB officers are simply lax, why are they not lax vis a vis new borrowers? The fact that default rates for PSBs are higher for borrowers with prior relationships than for new borrowers, conditional on the underlying score, suggests an element of active intent. Perhaps PSB loan officers genuinely believe they know their prior clients or want to emphasize relationship building, perhaps there is corruption (though it is then puzzling why their behavior with new borrowers would not involve corruption to the same degree). At any rate, there do appear to be costly behavioral differences between PSB loan officers and NPB loan officers vis a vis loan applicants with prior relationships.

IV. Regression Analysis

We now substantiate the univariate inquiry and delinquency patterns reported in Tables 4 and 5 with regression analysis. The regressions let us correct for applicant characteristics, loan characteristics (where necessary), and time period-specific unobservable effects.

The applicant characteristics the specifications control for include applicant age and gender, two demographic variables made available to us. The gender variable is motivated by evidence that women take less risk (e.g., Dwyer, Gilkeson, and List, 2002) possibly due to less overconfidence (Barber and Odean, 2001; Huang and Kisgen, 2012) or intrinsic biological differences such as the blood chemistry of individuals (Sapienza, Zingales, and Maestripieri, 2009). We control for age by including log borrower age as a control. Young borrowers may be riskier than older borrowers because they have less income, borrowing, and histories of managing credit. We control for the type of loan (housing, auto, or consumer), as well as the log of the loan amount in rupees.

The dependent variable in the Table 6 specifications is an indicator of whether the filtered application is inquired or not. In model [1], the explanatory variables include applicant characteristics, quarter indicators, indicators for whether the bank is a PSB, and whether the bank had a prior relationship with the borrower. In model [2], we further add an interaction between the PSB and a prior relationship indicator. In models [3] and [4], we include indicators for low, medium, and high scores and these indicators interacted with the PSB indicator.

The estimated coefficient on public sector banks is negative and significant at the 1% level in all specifications. The probability of initiating an inquiry by a PSB is between 14% and 25%

lower than for NPBs after controlling for borrower and loan characteristics, and time effects. We also find that on average, borrowers with past relationships are less likely to be inquired. The indicators for high, medium, and low credit scores have positive coefficients in model [3], indicating that scored populations are more likely to be inquired compared to the unscored population, more so by PSBs given the positive coefficient on the interaction between the score dummies and PSBs in model [4]. That is, all else equal, PSBs are more likely to inquire for scored borrowers compared to ones without scores. We see that they are slightly more inclined to inquire for low and high score borrowers than for borrowers with middle scores, as earlier suggested by Figure 1.

In Table 6, the specifications control for age and gender, two demographic variables made available to us. Banks are more likely to initiate inquiries for male borrowers when credit scores are not controlled for (models [1] and [2]). However, conditional on credit scores, males are not likely to be inquired more compared to females (models [3] and [4]). We also control for age by including log borrower age as a control. We find that conditional on credit scores, banks inquire less for older borrowers.

We next explore the relationship between inquiry and delinquency rates to assess whether inquiries have informational value in explaining delinquency, or a loan being past due for at least 90 days. While an OLS estimator gives similar results, we report the estimates of an IV specification. The first-stage exclusion restriction is that the indicators for PSB and PSB interacted with prior relationships affect delinquency rates only through inquiry. More specifically, if PSB loan officers tend to avoid inquiry, especially for loans with prior relationships, for instance, because some loan officers do not believe they need the information or the organizational culture of PSBs imparts a pro-relationship bias towards borrowers with prior relationships, we can instrument inquiries with the PSB indicator and also its interaction with the prior relationship indicator. The coefficient for inquiry in the second stage delinquency regression will then reflect the effect of inquiring on loan delinquency LQ360. We will discuss possible alternative interpretations shortly.

An important concern is that we do not quite know what information loan officers already have when they inquire. One possibility is that they know the broad credit quality bucket of the applicant – whether she is unscored, or has a low, medium, or high credit score. Some of the evidence we have seen thus far suggests this possibility. If so, the act of inquiry establishes the detailed credit score only, and to estimate the incremental impact of inquiring on delinquencies, we must correct for the information that the loan officer already has. This is what we will do in the regression analysis we present. If, however, the loan officer does not know the broad

credit quality bucket of the applicant, then the coefficient estimate for the inquiry indicator will underestimate the value of information obtained from inquiry. So for robustness, we also estimate the first and second stage assuming the loan officer has no information on the applicant beyond demographics. We obtain similar results. For brevity, we do not report these results.

We report the results in Table 7. The first stage instruments are strong (models [1] and [3] of Table 7).[18] Models [2] and [4] in Table 7 indicate that delinquency rates are significantly lower for loans inquired with the bureau. Variants of this specification with or without loan type or time period fixed effects, or with the second stage restricted to the same data as the first stage, give similar results. The magnitude of the estimated effects suggests that on average, conditional on several borrower and loan characteristics, inquired loans are associated with approximately a one percentage point reduction in default rates compared to loans that are not inquired. This is sizeable, given overall default rates of 1.34% for PSB loans and 1.27% for NPB loans.

Discussion We have seen thus far that PSBs are slower in using the new information available from credit bureaus, primarily for customers with whom they had a prior relationship. Over time PSBs increase the frequency of inquiry, even for clients with prior relationships. It may well be that PSB managements decide to make inquiries compulsory over time for all loan applications, thus removing loan officer discretion. It may be that loan officers themselves learn from past experience of higher default rates in un-inquired loans, and move to greater inquiry. Regardless of the reason, the slow pace of credit bureau adoption, or lending without inquiry, by PSBs certainly seems to result in greater delinquencies for PSB loans.

The estimated coefficient on inquiry in the second stage needs careful interpretation, though. It is tempting to interpret it as the average "treatment" effect of inquiry – that is, the value (in lowering delinquencies) of the additional information obtained from inquiry. Yet, the interpretation depends crucially on why we think PSB loan officers do not inquire as much as NPB loan officers. It is the average treatment effect if a random set of PSB loan officers simply dispense with inquiry for prior clients, or if all PSB loan officers inquire a random subset of their prior borrowers. One explanation for the former is if PSB loan officers simply do not think the technology is useful, especially relative to the information they have from prior relationships. Of course, PSB loan officers would vary in the extent that they think the technology useful. If this is the factor prompting inquiry among PSB loan officers, it will have nothing to do with the underlying quality of the loan. If so, PSB loan inquiry can be taken as

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[18] The F-statistic for the exclusion restriction exceeds 15.

unrelated to the underlying quality of the applicant, and the selection effect is negligible. The estimated coefficient on inquiry then reflects the information left on the table by their lack of inquiry – the value added by the credit bureau.

Alternatively, if PSB loan officers, based on their prior relationship, actively avoid inquiring for those that they believe might be rejected based on the likely scores that might be returned, then the act of not inquiring signals bad news and reflects some selection. Given the earlier evidence that PSB loan officers do seem to be selective in whom among prior relationship clients they inquire – typically those with higher credit quality that are likely to return a strong score and not impede lending – the likely bias is that the coefficient overestimates the incremental information provided by the credit bureau. What is clear, however, comparing PSB performance on lending into prior relationships with their performance on new loans, as well as with their performance relative to NPB performance on prior relationships, is that altering loan making practices at the PSBs to prior clients would reduce default rates.

Finally, it may be that PSBs charge higher interest rates to compensate for the additional risk they take from lending un-inquired to prior relationships. Unfortunately, we do not have interest rates charged on loans but our discussions with bankers, as well as the data, suggest this is not the right explanation. The information acquired through the small and relatively cheap additional step of inquiring would be subject to free disposal. It is hard to think that if PSB loan officers were maximizing value by lending to riskier credits and charging high rates, they would not acquire that additional information. Value maximization through non-inquiry also does not explain the increase in inquiries over time. Moreover, bureau usage rates for new applicants are high from the outset – why would a similar strategy of value maximization through non-inquiry work for them. These factors do not suggest that avoiding inquiry is a strategy to exploit high spreads.

V. Counterfactuals

By not inquiring enough, PSBs do not use credit score data that are available with bureaus. What would the PSB credit outcomes be if they instead made used the data for the un-inquired loans? We attempt to answer this question through counterfactual inferencing using the credit score data available with the bureau but that the PSBs did not use. Specifically, for un-inquired loans, the bureau supplies us point-in-time credit scores that would be seen by the PSBs had they inquired. Under reasonable assumptions about how the data would have been used by PSBs, we can estimate the counterfactual lending decisions and their outcomes under

expanded bureau usage. The differences between the counterfactual outcomes and actual realizations of un-inquired loans give us an estimate of the information left on the table by not inquiring.

To describe the methods more precisely, we introduce some notation. Let c identify a borrower, X_c denote borrower characteristics, and S_C the borrower's credit score. Let I_C be the event of inquiry and NI_C the non-inquiry for a loan, L_C be the amount of the loan to customer C. We let p_c (B, X_c, S_c) denote the composite NPB loan decision associated with bureau usage and lending conditional on usage -- the composite total probability that a filtered inquired application turns into a loan. Let $LQ_C(B)$ the ex-post delinquency rate for the loan made by bank type $B \in \{PSB, NPB\}$.

How might PSBs have used the bureau information for un-inquired loans had they instead inquired? Possible policy functions include an aggressive full inquiry policy in which PSBs mimic what they do for their new borrowers, that is, they check scores for all customers. In our view, this is an extreme assumption. It is perhaps more reasonable to model PSBs as following the policies of NPBs in using bureaus. That is we model PSBs as using both the inquiry practices (given filtered applicant characteristics) and the lending conditional on inquiry used by NPBs in granting credit. This approach produces more conservative estimates of the improvements in credit quality from expanded bureau usage compared to aggressive full usage. We assume that changing the policy does not change the nature or quality of filtered loan applications.

A second question in the counterfactual estimation is how we should model the delinquency rates after PSBs adopt NPB practices. We explore two possibilities. In one approach, we keep delinquency rates at their current realizations for PSBs. In other words, any reduction in delinquency rates would simply be because the PSB altered the probability of granting a loan to that followed by an NPB. A second candidate for counterfactual delinquency rates is the current *NPB* rate for similar loans. These rates are better approximations if, after greater adoption of bureau technology, the underlying default rate of loans made also falls, for example because PSBs improve their ex-post monitoring to NPB levels.

One output of the counterfactual estimation exercise is the loan supply function Q(.),

$$Q_{NI \to I}(PSB) = \sum p_c(NPB, X_c, S_c) \times L_C \times \delta_{c, NI}, \tag{1}$$

where the data comprise loans made by PSBs, $\delta_{C,NI}$ denotes a dummy variable that equals 1 if loan C is not inquired, and L_C is the amount of loan C. In essence, for each non-inquired loan that was made, we model the probability that the loan would be made using NPB decision functions. Because $0 \leq p_c(.) \leq 1$, loan volumes in the counterfactual $Q_{NI \to I}$ (PSB) $\leq Q_{NI}$ (PSB).

A second output of the counterfactual exercise is loan quality. If the delinquency rate is unaltered, it is simply the current realization $LQ360_C$

$$LQ360_{NI \to I} \text{ (PSB)} = \sum p_c(NPB, X_c, S_c) \times L_C \times \delta_{c,NI} \times LQ360_C, \qquad (2)$$

If the loan management practices change, delinquencies migrate to the NPB rates, so

$$LQ360_{NI \to I} \text{ (PSB)} = \sum p_c(NPB, X_c, S_c) \times L_C \times \delta_{c,NI} \times LQ360_C \text{ (NPB)}, \qquad (3)$$

Table 8 reports the counterfactual estimates for both the delinquency models discussed above. We report two sets of estimates, one for prior relationship borrowers and another for borrowers without a prior relationship. In both cases, we estimate the loan supply if PSBs follow NPB decision-making rules in granting credit and two delinquency rates, one of which is the current delinquency rate and another is the estimated delinquency rate based on NPB lending data for similar borrowers. Table 8 thus reports three delinquency rates. One is the actual delinquency rate for the portfolio of PSB loans made without inquiry. Counterfactual 1 is delinquency rate if the PSBs follow the NPB screening practices but the delinquency rates remain as currently realized. Counterfactual 2 in Table 8 is the delinquency rate when the PSB follows the NPB screening practices and the delinquency rates are the predicted realizations based on NPB experiences for similar loans. All supporting regressions for the counterfactual analysis are not reported here but are available upon request.

We find that both the counterfactual delinquency rates decrease below the levels experienced currently by PSBs for their un-inquired lending portfolio. The baseline delinquency rate in Table 8 is about 1.30%. Counterfactual 1 shows that if PSBs simply followed NPB bureau usage practices, the delinquency rates decrease to 0.70% and 0.97% for new relationships and for prior relationships, respectively. These estimates reflect the effects of better *ex-ante* screening from switching to the more intensive credit bureau checks conducted by PSBs. Counterfactual 2 in Table 8 shows that PSBs would experience a further reduction of delinquency rates to 0.57% if the greater adoption of bureau usage is accompanied by complementary shifts in loan management protocols. These estimates reflect the effect of

both better *ex-ante* screening achieved through higher inquiry rates as well as potentially better *ex-post* loan monitoring resulting in the NPB delinquency rates rather than the current realizations.

In proportionate terms, the greater adoption of credit bureaus produces improvements of between 31% and 47% in delinquency rates. The gains are greater for borrowers with no prior relationships, indicating that internal data partially but not fully offsets the advantages of bureau inquiries. The gains from a shift to NPB delinquency rates add a further 13 to 40 basis points, an additional gain of between 10% to 30%.

VI. Discussion of Results

What might explain the lag in adoption of credit bureaus by public sector banks for clients with whom they have prior relationships? We note that it is not that the PSBs are unfamiliar with technology, or the information they get from it. PSBs seem perfectly capable of using bureau data for new loan applicants. Furthermore, it does not seem they are avoiding inquiry because of laziness. After all, they do inquire nearly all new applications.

The PSBs appear to want to exercise discretion vis-a-vis their prior customers --they are reluctant to subject old relationships to the discipline of market data. If the credit bureau returns a score that conflicts with what the internal information indicates, it is harder for a loan officer to justify the loan decision. For example, if the internal data on a prior relationship borrower indicates that the borrower is of modest quality and the bureau returns a very low credit score, it is hard for the loan officer to override the score without arousing suspicion, so better not to inquire in the first place if it is not mandated. Conversely, if they do inquire, they are constrained to make appropriate credit decisions – perhaps why delinquencies for inquired PSB loans, even for those to prior relationships, is generally lower or commensurate with inquired NPB loans. Of course, when a borrower is intrinsically high quality, loan officers might inquire simply because they know how the answer will turn out. This is perhaps why PSB inquire more for high quality credits.

We saw a similar rationale for inquiry aversion, for instance, in the loan granting patterns in Table 4. PSBs were significantly less likely to give a loan conditional on inquiry than NPBs *but only if the credit report returns a score*. If the credit report returns "no score", the PSBs were more likely to grant a loan than NPBs, but only if the borrower has a prior relationship. In other words, PSBs may be bound to stricter loan granting criteria based on credit bureau

information, which is why they may be reluctant to inquire in the first place. But if they do inquire, and the credit bureau returns no information, they regain discretion.

Examining the delinquency rates, we find that for loans to prior relationship clients that are inquired and return "no score," average delinquency rates for PSBs is 1.03% while the corresponding rate for NPBs in 0.64% (Table 5, Panel B). In contrast, for loans to those without prior relationships – where PSB loan officers have no reason to be accommodative – the PSB delinquency rate of 0.71% is not just lower than the rate for those with whom it has had a prior relationship, it is lower than the corresponding rate for NPBs of 1.52% (Table 5, Panel C). In general, the fact that default rates for PSB loans to those with prior relations seem to be uniformly higher than loans to new borrowers, the reverse of the case with NPBs, suggest PSB discretion comes at a cost in terms of higher delinquencies.

We do not know if there are benefits to inquiry aversion. Revealed preference suggests there are not, or at least that the benefits are decaying over time. Over time, PSBs seem to be moving to eliminate the discretion about whether to inquire, perhaps as their managements learn from technology adoption that the bureau technology is useful. Of course, it may also be that as information about clients makes its way to the credit bureaus, relationships become less profitable, which is why PSBs are moving to inquire more. For instance, as banks are forced to populate data on loan performance for their unscored clients, they may lose any ability to hold on to the good ones amongst them. Since we don't have data to measure any benefits of the bank holding on to clients, we do not know if this is enough to offset higher delinquency rates.

Finally, is what we see a consequence of corruption, a concern that plagues all lending by public sector banks? Perhaps, but as indicated above, discretion may be used well rather than misused if the loan officer is intent of maintaining strong client relationships that are profitable in other ways, with the loan being the loss leader. Moreover, if they wanted to be corrupt, they could exercise some "discretion" for the unscored new applicants. They do not seem to do that, employing stricter criterion than even the NPBs. Instead, our preferred explanation is their initial aversion to inquiring for clients with a prior relationship is their aversion to transactional interactions where every transaction is evaluated on its intrinsic merits, and there is no room for relationships (or even friendship). PSBs may be reluctant to lose their ability to help the old customer, and give up discretion by adopting the new credit information technology. If this is the explanation, the immediate question is whether PSBs do this because of their "public sector" nature. Is there something associated with the state ownership of these banks that allows them to take a longer term, less transactional, view?

VII. Old Private Banks

Public sector ownership is a discrete variable and does not vary across banks in India. However, another set of organizations, old private banks or OPBs, shed light on whether it is ownership alone that drives the bureau adoption patterns of PSBs. We have 14 OPBs in our sample. These banks have a median age of 89 years, which is similar to the median and mean of 87 years for PSBs. The OPBs share similar formative experiences as the PSBs through the earlier, less-competitive era, where the Indian economy grew slowly and there were significant areas of oligopolistic rents the banks could exploit. The one difference is that OPBs escaped nationalization in 1969 and 1980 because they were regarded as being too small. To the extent that culture is a product of an organization's formative experiences, OPBs may share the inward relationship orientation of banks. If so, we should find OPBs resembling PSBs, with whom they share common formative periods and not NPBs, whom they resemble in ownership but not formative experiences.

OPBs also let us filter for bank size. OPBs, perhaps scarred by the nationalization of private banks that grew too big, have remained small. For instance, in the 1% random sample between 2006 and 2013, OPBs have 35,838 total loans, which is about 10% of the number of loans made by NPBs in the same period for the 1% sample. If OPBs behave like PSBs, it would appear that size alone *cannot* explain the technology adoption behavior of PSBs.

In Table 9, we present data on inquiry intensities for OPBs for the 1% random sample. As before, we exclude agricultural, priority sector, and gold loans. Panels A, B, and C present the data for all loans, new borrowers, and prior relationship borrowers, respectively. We find that the inquiry behavior of OPBs differs sharply from NPBs and is close to PSBs. In fact, the rates of usage of credit bureaus for OPBs are even lower than those for PSBs. For instance, for prior relationship borrowers, OPBs have a bureau usage rate of 14.44% over the full sample period (Panel B, Table 9), which is less than the 20.01% bureau usage rate for PSBs over the same time period (Panel A, Table 3B). However, for customers with no prior relationship with the inquiring bank, OPBs report bureau usage of 99.11% (Panel A, Table 9), or nearly full usage for all borrowers. Therefore, like PSBs, OPBs are also slow in adopting new technology, however, again only for existing clients.

In Figure 3, we plot the fraction of loans made after inquiry against the log of bank age. While there are two distinct clusters, reflecting the PSBs and OPBs at the older end and NPBs at the younger end, the banks with intermediate age align along the straight line. It would appear that bank age or culture is an important determinant of practice, even though the environment has changed substantially.

The bottom line of this section is that we observe two types of organizations, PSBs and OPBs, that are of similar vintage and that have similar legacy systems and cultures but are of very different sizes and ownership. Given their similar behavior, it would appear that neither size nor ownership solely explain their organizational practices related to the adoption of credit bureau technologies. Shared formative experiences are perhaps a more important factor in explaining the organizational responses to this new technology.

VII. Implications and Related Literature

Our findings are relevant to several areas of research in economics and finance, in particular the work on the adoption of better management practices but also the literature on technology adoption, credit bureaus, and state-owned banks.

Better Management Practices As Bloom and van Reenen (2010) discuss in their survey, there is an astounding difference in productivity of enterprises between firms and countries, which they attribute to non-adoption of modern management practices. Hsieh and Klenow (2009) find that firms in emerging markets are less productive than firms in developed economies. Experimental evidence on textile mills (Bloom, Eifert, Mahajan, MacKenzie, and Roberts, 2013), in agriculture (Cole and Fernando, 2016), and on small and medium enterprises in Mexico (Bruhn, Karlan, and Schoar, 2018) confirms this point and notes that using modern management practices improves productivity.

Our study complements the literature on better management practices in a number of ways. First, we provide direct microeconometric evidence from the field on the (non-)adoption of a new management practice, credit scoring in retail lending, which is a standard practice in consumer lending in developed markets. Our evidence sheds light on the nature of the frictions that impede adoption. The list suggested by Bloom and van Reenen (2010) and Bloom et al. (forthcoming) include imperfect markets, ownership, regulations, and informational barriers. Our evidence suggests that stasis is not necessarily a product of ownership or size; it can also be a product of organizational cultures from firms' formative experiences. How organizational culture can impact economic decision-making and outcomes is the focus of recent work in economics and finance (Guiso, Sapienza, and Zingales (2006, 2015); Graham, Harvey, Popadak, and Rajagopal, 2017).

Moreover, our evidence reveals a finer texture on the adoption question. In our study, the new practice, scoring technology to improve lending outcomes, is adopted instantly for new borrowers but banks are reluctant to use the same new technology for existing borrowers. The frictions that impede adoption are relation-specific.

Credit Bureaus Both credit bureaus and credit registries have attracted considerable academic and policy interest. One part of the literature emphasizes the role of bureaus in alleviating information asymmetry, which has the potential to alter the flow of credit. Much of the recent work exploits the richness of the bureau and registry data to assess questions such as the transmission of monetary policy.[19]

Our study has a somewhat different focus relative to prior work on bureaus. We use credit bureau data to gain a micro-level understanding of the credit decision practices of different types of banks. A second difference is the context. While prior work draws bureau or registry data from developed markets in which credit bureaus are well established, we study the initial introduction of credit bureaus. Moreover, we focus on India, which is a large economy that is undergoing a boom in the consumer lending market.

Perhaps as importantly, we bring to light a point that has received limited attention in prior theory and empirical work on bureaus, viz., banks do *not* use credit bureaus to inform all their loan decisions. We show that the incomplete usage of bureau data leaves information on the table, a finding that supports the focus of policy work, e.g., The World Bank's *Doing Business* section that emphasizes the specialness of credit bureaus in instilling credit discipline.

State-Owned Banks LaPorta, Lopez-de-Silanes, and Shleifer (2002) note that state ownership of banks is common across the world, possibly because state ownership of banks lets them undertake developmental activities necessary for growth that private banks do not. In practice, however, LaPorta et al. find that state ownership of banks has a reliable *negative* correlation with development. Several empirical studies suggest that the anomaly is likely due to the politically-induced distortions in credit flows (Sapienza, 2004; Khwaja and Mian, 2005; Dinç, 2005, Cole, 2009).[20] As *The Economist* (September 2015) writes, a key question is ``... the [state-owned] system's ability to capitalize on its successes when it wants to innovate rather than to catch up…'' The ability of state-owned enterprises to absorb innovative technologies is, of course, our main focus.

The Adoption of Innovation The term "innovator's dilemma" (Christensen, 1998) refers to a pattern where incumbents are slow to introduce innovative products because the new

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[19] See Artigas (2004), Djankov, McLiesh, and Shleifer (2007), or the credit section of World Bank's doing business survey at http://www.doingbusiness.org/data/exploretopics/getting-credit. The literature includes Pagano and Jappelli (1993), Padilla and Pagano (1997, 2000), Brown, Jappelli, and Pagano (2009), Hertzberg, Liberti, and Paravasini (2011), Karapetyan and Stacescu (2014), Jimenez, Ongena, Peydro, and Saurina (2012, 2014, forthcoming), and Ippolito, Peydro, Polo, and Sette (2016). See also Puri, Rocholl, and Steffen (2011).
[20] See Shleifer (1998), Caprio, Laeven, and Levine (2007), Estrin, Hanousek, Kocenda, and Svejnar (2009), Megginson (2010), Karolyi and Liao (2010), and Dinç and Gupta (2011) or the special reports carried by *The Economist* in 2012 ("The Visible Hand," http://www.economist.com/node/21542931) and 2015 ("The good, the bad, and the ugly," September 12, 2015)

products cannibalize current ones. This bias towards "status quo" results in incumbents losing market shares to newer firms more open to innovation. Our study suggests a parallel to the innovator's dilemma in the process adoption rather than the new product introduction space.

IX. Conclusions

We study a subset of data held by a major credit bureau in India that records virtually all consumer loans granted during the last decade by credit institutions operating in India. The main focus of our study is the adoption of credit scoring by the banking sector in retail consumer lending, specifically the differences in adoption between state-owned or public sector banks (PSBs) and new private banks (NPBs).

We show that there is a significant gap in adoption of credit scoring technology between the two, even a number of years after the introduction of the technology. For borrowers with prior relationships, PSB inquiry rates are lower than those for their private peers, NPBs, who subject virtually all loans to credit bureau check. The difference does *not* exist for new clients, so the inquiry difference for customers with prior relationships does not appear to reflect a general aversion towards new technology adoption by PSBs.

We test and rule out a variety of explanations for slow adoption. We also examine the possibility that the credit bureau information is redundant for PSBs but do not find evidence to support this viewpoint. Our tests suggest that by lending without inquiry, PSBs enhance the risk of default. We conduct further tests on loans made without inquiry. For these loans, we obtain data on the real-time credit scores that PSBs would have seen if they had inquired instead of lending without inquiry. Under plausible assumptions about how the data would be used in lending, we estimate counterfactual outcomes if the un-inquired loans were instead inquired, and quantify the real-time improvements in credit quality generated from greater adoption of the credit scoring technology.

A potential explanation for the differences in behavior may lie in the distinctive cultures of the two types of organizations. An organization that moves to a score-driven, transaction orientation in lending has to remove discretion from the loan officer and cede it to the scoring technology. Our findings suggest that PSBs are more reluctant to shift, perhaps because it is disruptive of status quo, particularly for borrowers with whom the banks have prior relationships, where internal data is more abundant and processes and human capital have been built around its use. Is the adherence to status-quo a product of state ownership? We find that old private banks, which are of similar vintage and have similar formative experiences as PSBs but are smaller and continue to be privately held, behave similarly to

PSBs. Perhaps shared formative experiences are thus an important organization trait in explaining the responses to new technology. Over time, the behavior of state-owned banks shows convergence towards that of their newer private bank counterparts, suggesting there is pressure to adopt. Competition appears to drive out the status quo bias created by relationships and replace it with arms-length transactional behavior typical of modern retail lending practices in banks around the world.

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Table 1
Inquiries and Loans for the Full 1% Sample

The table reports data on inquiries made by banks with the credit bureau and loans made with or without credit bureau inquiries. The data comprises a 1% random sample of all loan types excluding credit cards and all lending inquiries between 2006 and 2015 at a major credit bureau in India. Filtered applications refer to the sum of the number of inquiries and the number of loans without inquiry. Bureau usage is the ratio of the number of inquiries to the number of filtered applications. Amounts are in billion rupees. The exchange rate at the end of our sample period is about US$1 = 65 rupees. Year refers to the fiscal year-end in March..

Year	# Filtered Applications	# Inquiries	Bureau Usage	# Loans No Inquiry	# Loans Inquired	% Loans No Inquiry	Amount (INR Billion)			% Amount Inquired
							Total	No Inquiry	Inquired	
2006	190,264	17,382	9.14%	172,882	5,150	2.89%	38.87	35.92	2.95	7.60%
2007	262,929	89,557	34.06%	173,372	21,403	10.99%	43.07	33.24	9.83	22.81%
2008	351,470	210,844	59.99%	140,626	44,127	23.88%	49.19	30.83	18.36	37.32%
2009	292,356	168,980	57.80%	123,376	32,673	20.94%	43.82	29.04	14.78	33.72%
2010	273,642	122,321	44.70%	151,321	33,250	18.01%	61.54	36.35	25.19	40.93%
2011	345,195	157,033	45.49%	188,162	51,403	21.46%	94.67	55.39	39.28	41.49%
2012	457,643	203,545	44.48%	254,098	80,227	24.00%	105.12	51.03	54.09	51.45%
2013	593,863	271,330	45.69%	322,533	101,746	23.98%	133.27	59.43	73.84	55.41%
2014	712,092	351,892	49.42%	360,200	131,576	26.76%	148.70	60.84	87.86	59.08%
2015	850,010	448,434	52.76%	401,576	177,439	30.64%	177.73	63.08	114.64	64.51%
Total	4,329,464	2,041,318	47.15%	2,288,146	678,994	22.88%	895.97	455.16	440.82	49.20%

Table 2
Inquiries and Loans for the Full 1% Sample: Classified by Bank Type

The table reports data on inquiries made by new private banks and public sector banks with the credit bureau and loans made with or without inquiring with the credit bureau. The 1% random sample includes all loan types excluding credit cards and all lending inquiries between 2006 and 2015 at a major credit bureau in India. Filtered applications refer to the sum of the number of inquiries and the number of loans without inquiry. Bureau usage is the ratio of the number of inquiries to the number of filtered applications. Amounts are in billion rupees. The exchange rate at the end of our sample period is about US$1 = 65 rupees. Year refers to the fiscal year-end in March. For example, 2015 refers to the year ending March 2015.

Panel A: Public Sector Banks

Year	# Filtered Applications	# Inquiries	Bureau Usage	# Loans No Inquiry	# Loans Inquired	% Loans Inquired	Amount Total	Amount No Inquiry	Amount Inquired	%Amt Inquired
2006	81,077	736	0.91%	80,341	194	0.24%	15.87	15.72	0.15	0.93%
2007	72,035	3,380	4.69%	68,655	1,116	1.60%	12.98	12.18	0.80	6.13%
2008	66,986	4,931	7.36%	62,055	1,700	2.67%	13.44	11.83	1.61	11.97%
2009	86,096	9,079	10.55%	77,017	3,010	3.76%	17.06	14.40	2.65	15.56%
2010	115,214	17,766	15.42%	97,448	6,394	6.16%	25.09	18.38	6.71	26.74%
2011	143,361	25,664	17.90%	117,697	8,425	6.68%	28.32	20.16	8.16	28.83%
2012	193,316	34,216	17.70%	159,100	11,222	6.59%	34.46	24.84	9.61	27.90%
2013	255,363	50,902	19.93%	204,461	17,080	7.71%	43.51	29.68	13.83	31.79%
2014	311,288	72,068	23.15%	239,220	24,485	9.28%	54.19	34.15	20.04	36.98%
2015	351,405	95,311	27.12%	256,094	33,838	11.67%	58.42	34.24	24.17	41.38%
Total	1,676,141	314,053	18.74%	1,362,088	107,464	7.31%	303.35	215.60	87.74	28.93%

Panel B: New Private Banks

Year	# Filtered Applications	# Inquiries	Bureau Usage	# Loans No Inquiry	# Loans Inquired	% Loans Inquired	Amount Total	Amount No Inquiry	Amount Inquired	%Amt Inquired
2006	48,136	4,334	9.00%	43,802	908	2.03%	11.28	10.72	0.56	4.96%
2007	78,862	32,310	40.97%	46,552	10,118	17.85%	13.88	9.38	4.50	32.43%
2008	105,448	82,774	78.50%	22,674	25,941	53.36%	12.55	4.81	7.74	61.65%
2009	70,286	61,834	87.97%	8,452	16,379	65.96%	6.09	1.54	4.55	74.75%
2010	48,485	41,423	85.43%	7,062	13,321	65.35%	7.19	1.54	5.64	78.52%
2011	61,263	52,640	85.92%	8,623	19,517	69.36%	13.31	2.13	11.18	84.00%
2012	82,802	67,478	81.49%	15,324	27,453	64.18%	19.01	2.88	16.13	84.86%
2013	110,792	90,671	81.84%	21,021	33,897	62.75%	25.66	4.27	21.39	83.36%
2014	136,302	115,875	85.01%	20,427	41,293	66.90%	27.02	4.32	22.69	83.99%
2015	173,313	148,058	85.43%	25,255	52,011	67.31%	36.62	5.42	31.20	85.19%
Total	915,689	697,397	76.16%	218,292	240,838	52.46%	172.61	47.02	125.59	72.76%

Inquiries and Loans in Final Sample: New Borrowers

The table reports data on inquiries with the credit bureau and loans made with or without inquiring by public sector banks and new private banks where the borrower or loan applicant has no prior lending relationship with the bank. The 1% random sample includes all loan types excluding credit cards, priority sector loans, and gold loans and all lending inquiries between 2006 and 2015 at a major credit bureau in India. Filtered applications refer to the sum of the number of inquiries and the number of loans without inquiry. Bureau usage is the ratio of the number of inquiries to the number of filtered applications. Amounts are in billion rupees. The exchange rate at the end of our sample period is about US$1 = 65 rupees. Year refers to the fiscal year-end in March. For example, 2015 refers to the year ending March 2015.

						Panel A: Public Sector Banks (PSBs)				
Year	# Filtered Applications	# Inquiries	Bureau Usage	# Loans No Inquiry	# Loans Inquired	% Loans Inquired	Amount Total	Amount No Inquiry	Amount Inquired	%Amt Inquired
2006	702	701	99.86%	1	163	99.39%	0.13	0.00	0.13	98.49%
2007	3,108	3,094	99.55%	14	871	98.42%	0.63	0.01	0.61	98.08%
2008	4,472	4,404	98.48%	68	1,298	95.02%	1.31	0.04	1.28	97.28%
2009	8,182	8,047	98.35%	135	2,302	94.46%	2.15	0.08	2.07	96.47%
2010	15,598	15,398	98.72%	200	4,783	95.99%	5.43	0.13	5.30	97.67%
2011	21,566	21,252	98.54%	314	5,630	94.72%	6.18	0.25	5.93	95.93%
2012	27,738	27,287	98.37%	451	6,610	93.61%	6.56	0.31	6.25	95.26%
2013	40,017	39,456	98.60%	561	9,215	94.26%	8.98	0.38	8.59	95.73%
2014	54,713	53,941	98.59%	772	12,221	94.06%	13.03	0.84	12.18	93.52%
2015	69,251	68,230	98.53%	1,021	14,824	93.56%	13.98	0.71	13.26	94.91%
Total	245,347	241,810	98.56%	3,537	57,917	94.24%	58.37	2.75	55.62	95.28%

						Panel B: New Private Banks (NPBs)				
Year	# Filtered Applications	# Inquiries	Bureau Usage	# Loans No Inquiry	# Loans Inquired	% Loans Inquired	Amount Total	Amount No Inquiry	Amount Inquired	%Amt Inquired
2006	3,454	3,440	99.59%	14	579	97.64%	0.36	0.01	0.36	98.38%
2007	22,233	22,009	98.99%	224	6,077	96.45%	2.66	0.09	2.57	96.58%
2008	54,485	54,067	99.23%	418	17,054	97.61%	4.20	0.15	4.04	96.33%
2009	39,850	39,766	99.79%	84	10,636	99.22%	2.45	0.04	2.41	98.52%
2010	27,375	27,270	99.62%	105	8,992	98.85%	3.31	0.06	3.25	98.30%
2011	35,220	35,099	99.66%	121	12,934	99.07%	5.87	0.10	5.76	98.27%
2012	45,575	45,408	99.63%	167	17,831	99.07%	8.17	0.11	8.05	98.62%
2013	60,468	60,250	99.64%	218	21,637	99.00%	10.90	0.12	10.78	98.90%
2014	76,082	75,802	99.63%	280	24,673	98.88%	12.05	0.31	11.75	97.44%
2015	96,461	96,200	99.73%	261	28,973	99.11%	15.48	0.20	15.28	98.72%
Total	461,203	459,311	99.59%	1,892	149,386	98.75%	65.44	1.18	64.26	98.19%

Table 3B
Inquiries and Loans in Final Sample; Prior Relationship Borrowers

The table reports data on inquiries with the credit bureau and loans made with or without inquiring by public sector banks and new private banks where the borrower or loan applicant has a prior lending relationship with the bank. The 1% random sample includes all loan types excluding credit cards, priority sector loans, and gold loans and all lending inquiries between 2006 and 2015 at a major credit bureau in India. Filtered applications refer to the sum of the number of inquiries and the number of loans without inquiry. Bureau usage is the ratio of the number of inquiries to the number of filtered applications. Amounts are in billion rupees. The exchange rate at the end of our sample period is about US$1 = 65 rupees. Year refers to the fiscal year-end in March. For example, 2015 refers to the year ending March 2015.

						Panel A: Public Sector Banks (PSB)				
Year	# Filtered Applications	# Inquiries	Bureau Usage	# Loans No Inquiry	# Loans Inquired	% Loans Inquired	Amount Total	Amount No Inquiry	Amount Inquired	%Amt Inquired
2006	32,636	35	0.11%	32,601	8	0.02%	8.05	8.04	0.00	0.03%
2007	26,975	286	1.06%	26,689	94	0.35%	6.86	6.77	0.09	1.32%
2008	22,623	527	2.33%	22,096	152	0.68%	6.37	6.24	0.13	2.00%
2009	26,629	1,032	3.88%	25,597	365	1.41%	7.61	7.33	0.28	3.69%
2010	33,009	2,368	7.17%	30,641	856	2.72%	9.91	9.09	0.81	8.22%
2011	35,296	4,412	12.50%	30,884	1,376	4.27%	10.44	9.29	1.16	11.08%
2012	38,631	6,929	17.94%	31,702	2,215	6.53%	10.57	8.94	1.63	15.42%
2013	39,617	11,446	28.89%	28,171	3,563	11.23%	10.79	7.89	2.90	26.91%
2014	49,605	18,127	36.54%	31,478	5,721	15.38%	13.33	8.98	4.36	32.67%
2015	56,084	27,081	48.29%	29,003	8,868	23.42%	13.67	7.49	6.18	45.20%
Total	361,105	72,243	20.01%	288,862	23,218	7.44%	97.61	80.07	17.54	17.97%

						Panel B: New Private Banks (NPB)				
Year	# Filtered Applications	# Inquiries	Bureau Usage	# Loans No Inquiry	# Loans Inquired	% Loans Inquired	Amount Total	Amount No Inquiry	Amount Inquired	%Amt Inquired
2006	43,090	894	2.07%	42,196	126	0.30%	10.16	10.12	0.04	0.36%
2007	54,758	10,301	18.81%	44,457	3,644	7.58%	10.17	8.61	1.56	15.36%
2008	48,952	28,707	58.64%	20,245	8,008	28.34%	7.20	3.99	3.21	44.58%
2009	27,605	22,068	79.94%	5,537	4,915	47.02%	2.76	1.08	1.68	60.89%
2010	19,262	14,153	73.48%	5,109	3,752	42.34%	2.86	1.05	1.81	63.21%
2011	23,729	17,541	73.92%	6,188	5,840	48.55%	5.82	1.65	4.17	71.59%
2012	29,460	22,070	74.92%	7,390	8,164	52.49%	8.31	1.83	6.48	77.96%
2013	37,827	30,421	80.42%	7,406	9,878	57.15%	10.94	2.48	8.46	77.34%
2014	46,451	40,073	86.27%	6,378	11,009	63.32%	11.25	2.24	9.02	80.12%
2015	57,424	51,858	90.31%	5,566	14,248	71.91%	15.21	2.51	12.70	83.48%
Total	388,558	238,086	61.27%	150,472	69,584	31.62%	84.70	35.57	49.13	58.00%

Table 4

Credit Bureau Inquiries and Lending by Credit Scores

The table reports data on inquiries and loans made by public sector banks and new private banks classified by whether the credit is scorable and credit score buckets where available for a 1% random sample of records at a major credit bureau in India in fiscal years ending in March 2013 and March 2014. Filtered applications refer to the sum of the number of inquiries and the number of loans without inquiry. Bureau usage is the ratio of the number of inquiries to the number of filtered applications. Amounts are in billion rupees. The exchange rate for the sample period is about US$1 = 65 rupees.

Score Bucket	# Filtered Applications	# Loans No Inquiry	# Inquiries	# L | I	Bureau Usage	P (L|I)	P (L|FA)
Panel A: New Borrowers							
Public Sector Banks							
≤ 650	5,566	67	5,499	408	98.80%	7.42%	8.53%
650-750	15,257	269	14,988	2,339	98.24%	15.61%	17.09%
≥ 750	12,998	217	12,781	2,130	98.33%	16.67%	18.06%
All Scores	33,821	553	33,268	4,877	98.36%	14.66%	16.06%
No Score	60,909	780	60,129	16,559	98.72%	27.54%	28.47%
Total	94,730	1,333	93,397	21,436	98.59%	22.95%	24.04%
Private Sector Banks							
≤ 650	8,748	34	8,714	878	99.61%	9.69%	10.04%
650-750	21,711	138	21,573	6,272	99.36%	28.43%	28.89%
≥ 750	10,842	45	10,797	3,073	99.58%	28.04%	28.34%
All Scores	41,301	217	41,084	10,223	99.47%	24.35%	24.75%
No Score	95,249	281	94,968	36,585	99.70%	38.23%	38.41%
Total	136,550	498	136,052	46,808	99.64%	34.04%	34.28%
Panel B: Prior Borrowers							
Public Sector Banks							
≤ 650	4,784	1,655	3,129	482	65.41%	15.40%	44.67%
650-750	22,704	10,322	12,382	2,915	54.54%	23.54%	58.30%
≥ 750	10,706	3,988	6,718	1,578	62.75%	23.49%	51.99%
All Scores	38,194	15,965	22,229	4,975	58.20%	22.38%	54.83%
No Score	51,028	43,684	7,344	4,309	14.39%	58.67%	94.05%
Total	89,222	59,649	29,573	9,284	33.15%	31.39%	77.26%
Private Sector Banks							
≤ 650	9,849	235	9,614	1,711	97.61%	17.80%	19.76%
650-750	26,878	939	25,939	9,601	96.51%	37.01%	39.21%
≥ 750	13,262	387	12,875	4,741	97.08%	36.82%	38.67%
All Scores	49,989	1,561	48,428	16,053	96.88%	33.15%	35.24%
No Score	34,289	12,223	22,066	4,834	64.35%	21.91%	49.74%
Total	84,278	13,784	70,494	20,887	83.64%	29.63%	41.14%

Table 5
Delinquency Rates LQ 360 By Bank Type, Relationships and
Credit Score Bucket

Panel A: All loans

	Public Sector Banks			New Private Banks		
	All	No Inq	Inq	All	No Inq	Inq
<=650	4.15%	5.45%	2.00%	2.14%	5.26%	1.90%
650-750	0.78%	0.97%	0.48%	0.76%	2.62%	0.68%
>=750	0.34%	0.46%	0.23%	0.25%	2.19%	0.17%
Scored	0.96%	1.29%	0.51%	0.74%	2.90%	0.64%
Unscored	1.52%	1.95%	0.78%	1.61%	2.89%	1.43%
All Loans	1.34%	1.75%	0.68%	1.27%	2.89%	1.11%

Panel B: Loans with prior relation

	Public Sector Banks			New Private Banks		
<=650	4.83%	5.98%	2.28%	1.30%	5.26%	1.11%
650-750	0.82%	0.95%	0.51%	0.51%	0.62%	0.51%
>=750	0.38%	0.48%	0.22%	0.19%	1.47%	0.14%
Scored	1.06%	1.29%	0.58%	0.49%	1.36%	0.45%
Unscored	1.12%	1.19%	1.03%	0.81%	1.99%	0.64%
All Loans	1.03%	1.24%	0.77%	0.61%	1.62%	0.49%

Panel C: Loans with no prior relation

	Public Sector Banks			New Private Banks		
	All	No Inq	Inq	All	No Inq	Inq
<=650	2.70%	3.85%	1.63%	3.76%	5.26%	3.56%
650-750	0.65%	1.08%	0.43%	1.16%	5.61%	0.94%
>=750	0.27%	0.39%	0.23%	0.36%	3.26%	0.23%
Scored	0.71%	1.33%	0.44%	1.14%	4.97%	0.93%
Unscored	0.85%	2.31%	0.71%	1.69%	2.99%	1.52%
All Loans	0.75%	2.22%	0.64%	1.49%	3.19%	1.39%

Table 6

*The dependent variable is one if a loan is preceded by a credit bureau inquiry and 0 for loans without inquiry. The data comprise a 1% random sample of the data held at the bureau for all loans made between 2013 and 2014 excluding credit cards, priority sector loans, and gold loans. PSB is an indicator for whether a bank is state-owned. Past relationship equals one if the borrower is recorded in the credit bureau records as having borrowed from the same bank in the past The specification includes indicators for credit score buckets and their interactions with the PSB indicator, and controls for gender, (log) age, and quarter-year time period fixed effects.. Standard errors in parentheses are clustered at borrower level. *** p<0.01, ** p<0.05, * p<0.1*

	(1)	(2)	(3)	(4)
PSB	0.2536***	-0.1593***	-0.1411***	-0.1914***
	(0.002)	(0.002)	(0.002)	(0.002)
Past Relationship	-0.0807***	0.0663***	-0.0332***	0.0039***
	(0.002)	(0.001)	(0.002)	(0.001)
Past relationship*PSB		-0.2965***	-0.2701***	-0.3310***
		(0.004)	(0.003)	(0.003)
Low Score			0.2265***	0.1419***
			(0.002)	(0.002)
Medium Score			0.1982***	0.1319***
			(0.002)	(0.002)
High Score			0.2346***	0.1390***
			(0.002)	(0.002)
PSB*Low Score				0.1811***
				(0.005)
PSB*Medium Score				0.1228***
				(0.003)
PSB*High Score				0.1735***
				(0.004)
Male	0.0260***	0.0222***	-0.0007	-0.0023
	(0.002)	(0.002)	(0.002)	(0.002)
Log (Age)	-0.0026	0.0113***	-0.0142***	-0.0105***
	(0.003)	(0.003)	(0.003)	(0.003)
Qtr-Year FE	Y	Y	Y	Y
# Observations	348,158	348,158	348,158	348,158

Table 7

The table reports 2SLS results. In the first stage, the dependent variable is an indicator for whether a loan is inquired or not. The instruments are whether the bank is state-owned (PSB), and this indicator interacted with whether a borrower is a past relationship borrower or not. In the second stage, the dependent variable is loan delinquency LQ 360, which is an indicator for whether the loan goes 90 days past due within 360 days of granting the loan. Standard errors are reported in parentheses and clustered at the level of an individual borrower. The explanatory variables include credit score buckets, borrower gender, log of one plus borrower age, log of one plus the loan amount in rupee, loan product type and quarter-year fixed effects. The results are similar when the fixed effects are excluded. *** p<0.01, ** p<0.05, * p<0.1.

	(1) First Stage	(2) Second Stage	(3) First Stage	(4) Second Stage
Inquired		-0.0115***		-0.0104***
		(0.003)		(0.003)
PSB	-0.2229***		-0.1474***	
	(0.002)		(0.002)	
Past Relationship	-0.1412***	-0.0060***	-0.0228***	-0.0061***
	(0.002)	(0.001)	(0.001)	(0.001)
PSB*Past Relationship			-0.2427***	
			(0.003)	
Low Score	0.1773***	0.0224***	0.1635***	0.0222***
	(0.002)	(0.003)	(0.002)	(0.003)
Medium Score	0.1398***	-0.0027***	0.1347***	-0.0028***
	(0.002)	(0.001)	(0.002)	(0.001)
High Score	0.1778***	-0.0057***	0.1671***	-0.0059***
	(0.002)	(0.001)	(0.002)	(0.001)
Male	0.0101***	0.0019**	0.0087***	0.0019**
	(0.002)	(0.001)	(0.002)	(0.001)
LN(Age)	-0.0259***	-0.0074***	-0.0152***	-0.0074***
	(0.003)	(0.001)	(0.003)	(0.001)
LN(1+Amt)		-0.0037***		-0.0036***
		(0.000)		(0.000)
Constant	1.0367***	0.0986***	0.9610***	0.0966***
	(0.010)	(0.008)	(0.010)	(0.007)
Product FE	N	Y	N	Y
Quarter-Year FE	Y	Y	Y	Y
# Observations	331,961	107,284	331,961	107,284

Table 8
Counterfactual Loan Supply and Delinquency Rates for PSB Loans Without Inquiry

The data comprise loans made by state-owned banks (PSBs) without inquiry in fiscal years 2013 and 2014 excluding priority sector and gold loans. For each loan, we estimate the probability of inquiry and probability of acceptance given inquiry based on inquiry and acceptance rates for new private banks (NPBs) whose estimates we do not report here. The loan supply is the product of the loan amount and the compound probability of inquiry and acceptance given inquiry. The actual delinquency rate is the realized delinquency rate for PSBs for the un-inquired pool of loans. Counterfactual 1 is the delinquency rate for the counterfactual loan supply using the realized delinquency rate on each loan. Counterfactual 2 is the delinquency rate for the counterfactual loan supply using the delinquency rate based on the projected rate for a loan of similar characteristics made by an NPB.

Past Relationship	Loan Supply	Delinquency Rate		
		Actual	Counterfactual 1	Counterfactual 2
No	281,603,448	1.33%	0.70%	0.57%
Yes	719,841,267	1.29%	0.97%	0.57%
All	1,001,444,714	1.29%	0.90%	0.57%

Table 9
Old Private Banks

The table reports data on inquiries with the credit bureau and loans made with or without inquiring by old private banks (OPBs) classified by whether the borrower or loan applicant has a prior lending relationship with the bank. The 1% random sample includes all loan types excluding credit cards, priority sector loans, and gold loans and all lending inquiries between 2006 and 2015 at a major credit bureau in India. Filtered applications refer to the sum of the number of inquiries and the number of loans without inquiry. Bureau usage is the ratio of the number of inquiries to the number of filtered applications. Amounts are in billion rupees. The exchange rate at the end of our sample period is about US$1 = 65 rupees. Year refers to the fiscal year-end in March. For example, 2015 refers to the year ending March 2015.

| Year	# Filtered Applications	# Inquiries	Bureau Usage	# Loans No Inquiry	# Loans Inquired	% Loans Inquired	Amount Total	Amount No Inquiry	Amount Inquired	% Amt Inquired
Panel A: New Borrowers										
2006	738	738	100.00%	-	152	3.21%	0.95	0.94	0.01	1.18%
2007	7,301	7,290	99.85%	11	1,003	22.18%	2.73	2.57	0.16	6.01%
2008	4,989	4,967	99.56%	22	274	13.51%	3.48	3.27	0.22	6.24%
2009	1,226	1,224	99.84%	2	56	3.00%	1.81	1.72	0.08	4.51%
2010	1,081	1,074	99.35%	7	150	6.76%	1.39	1.17	0.22	16.06%
2011	1,626	1,619	99.57%	7	300	13.74%	1.71	1.17	0.54	31.41%
2012	2,135	2,113	98.97%	22	468	17.75%	2.55	1.30	1.25	49.19%
2013	2,439	2,385	97.79%	54	448	19.11%	3.84	1.73	2.11	54.98%
2014	3,324	3,260	98.07%	64	634	25.57%	3.19	1.35	1.84	57.63%
2015	5,456	5,374	98.50%	82	692	28.51%	4.05	1.53	2.52	62.18%
Total	30,315	30,044	99.11%	271	4,177	16.34%	25.71	16.75	8.96	34.85%
Panel B: Prior Relationship Borrowers										
2006	4,911	20	0.41%	4,891	10	0.20%	0.94	0.94	0.00	0.04%
2007	3,928	220	5.60%	3,708	57	1.51%	2.58	2.57	0.01	0.36%
2008	2,263	281	12.42%	1,982	39	1.93%	3.29	3.26	0.02	0.73%
2009	2,057	86	4.18%	1,971	5	0.25%	1.72	1.72	0.00	0.11%
2010	2,564	186	7.25%	2,378	23	0.96%	1.22	1.16	0.05	4.24%
2011	2,929	336	11.47%	2,593	114	4.21%	1.33	1.17	0.16	11.97%
2012	3,812	557	14.61%	3,255	239	6.84%	2.08	1.28	0.80	38.45%
2013	3,909	792	20.26%	3,117	301	8.81%	3.10	1.69	1.41	45.52%
2014	3,932	1,070	27.21%	2,862	371	11.48%	2.13	1.27	0.86	40.30%
2015	4,420	1,465	33.14%	2,955	519	14.94%	2.70	1.49	1.21	44.80%
Total	34,725	5,013	14.44%	29,712	1,678	5.35%	21.09	16.56	4.53	21.47%

Figure 1

Panel A: Fraction of Loans with Inquiry
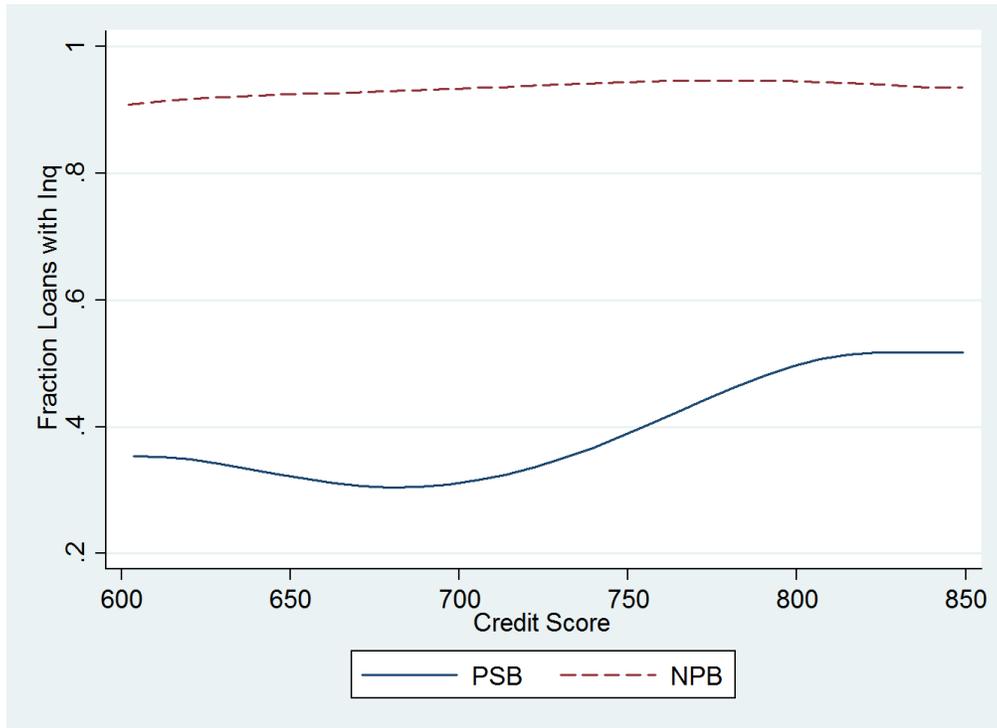
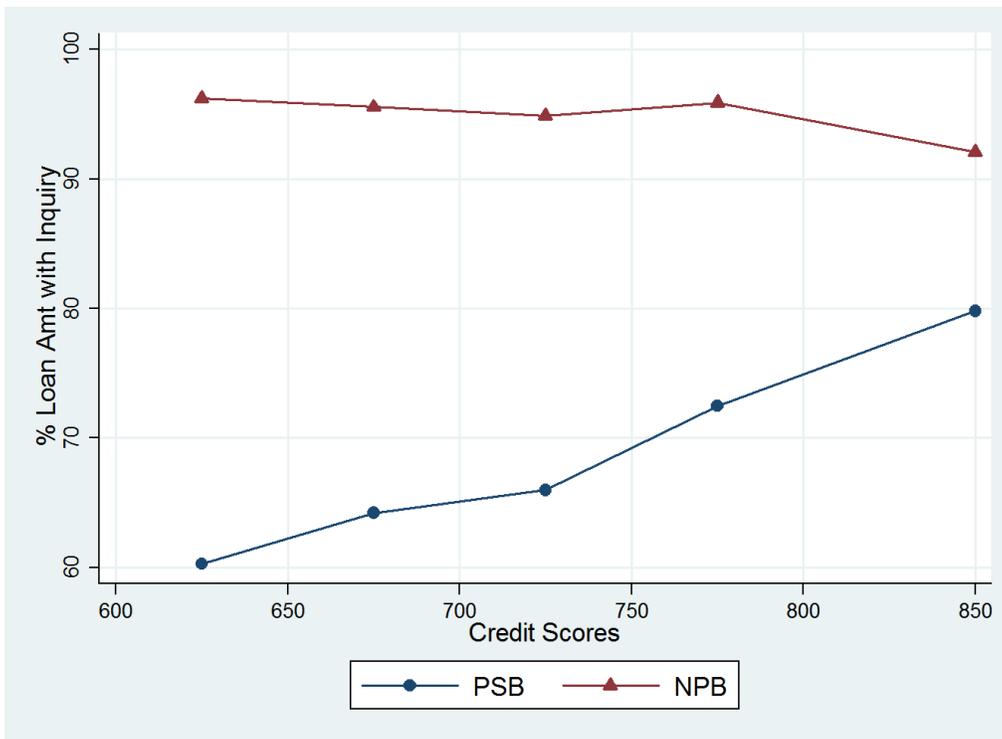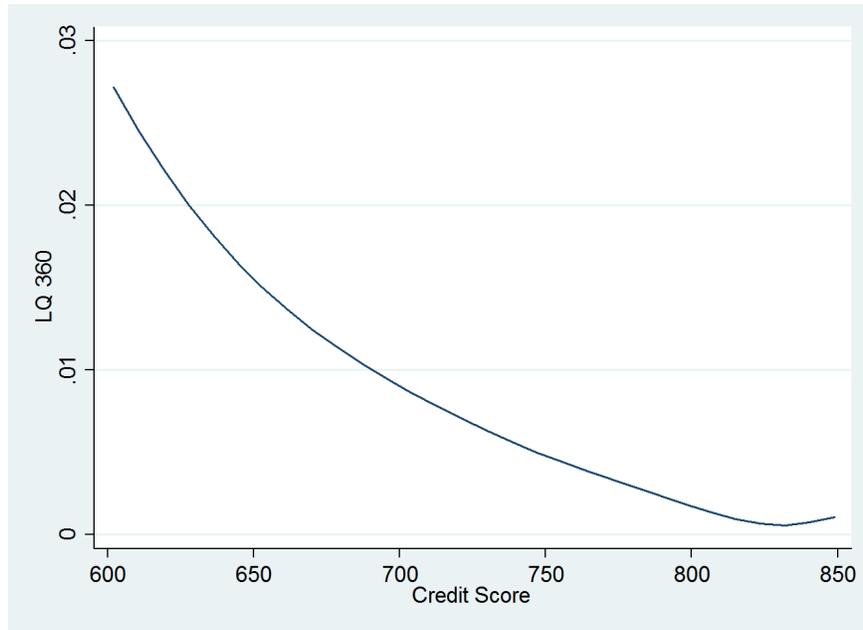*Panel B: Fraction of Loan Amount with Inquiry*

Figure 2

Panel A: Delinquency LQ360 Versus Credit Score (All Banks)

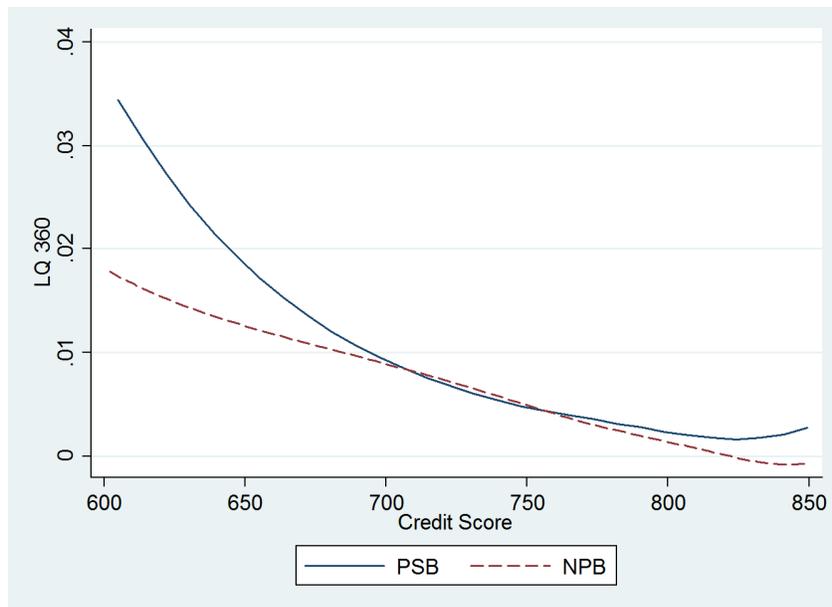*Panel B: LQ 360 versus Credit Score (PSBs and NPBs Separately)*

Figure 3

Percentage Loans Inquired by Bank Age