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Vasso P. Ioannidou *
Tilburg University
Department of Finance & CentER
PO Box 90153
NL 5000 LE Tilburg
The Netherlands
Telephone: +31 13 466 3097
Fax: +31 13 466 2875
E-mail: v.p.ioannidou@tilburguniversity.nl

María Fabiana Penas
Tilburg University
Department of Finance CentER & TILEC
PO Box 90153
NL 5000 LE Tilburg
The Netherlands
Tel: +31 13 466 8150
Fax: +31 13 466 2875
E-mail: m.penas@tilburguniversity.nl

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Deposit Insurance and Bank Risk-Taking: Evidence from Internal Loan Ratings

Abstract

This paper analyzes the effect of deposit insurance on banks' risk-taking in the context of a natural experiment using detailed credit registry data. We study the case of an emerging economy, Bolivia, that introduced a deposit insurance system during the sample period, and we compare banks' risk-taking before and after the introduction of this system. We find that after the introduction of deposit insurance, banks are more likely to initiate riskier loans (i.e., loans with worse ratings at origination). These loans carry higher interest rates and are associated with worse ex-post performance. We also find that collateral requirements and loan maturities are not adjusted to compensate for the extra risk. Additional results suggest that the increase in risk-taking is due to a decrease in market discipline from large depositors. Our findings also suggest that differences in risk-taking between large (too-big-to-fail) and small banks diminished after deposit insurance.

Keywords: deposit insurance, risk-taking, too-big-to-fail, internal credit ratings

JEL Classification: G21, G28

I. Introduction

This paper investigates the effect of deposit insurance on banks' risk-taking in the context of a natural experiment using detailed credit registry data, which allow us to investigate the effect of deposit insurance on contemporaneous and ex-ante risk-taking.

We study the case of Bolivia, an emerging economy that introduced a deposit insurance system in December 2001 and we compare the risk-taking behavior of banks before and after the introduction of this system. The comparison is between ambiguous implicit guarantees and explicit deposit insurance, with flat-insurance premiums and partial coverage for all depositors. Introducing explicit deposit insurance was part of the country's efforts to conform to the blueprints of international financial architecture— like many developing countries and emerging markets have done in recent years.[1] Bolivia provides a good case study since the introduction of the system did not coincide with other regulatory changes.

The analysis employs a unique database with detailed information on the population of loans granted by any bank operating in the country between 1999 and 2003, including internal credit ratings, contract features, and ex-post performance. We focus on loan initiations ("fresh loans") and internal credit ratings at origination to measure risk-taking. In other words, we examine whether after the introduction of deposit insurance, banks are more likely to initiate loans to borrowers *they know* are riskier.[2] We also examine whether they adjust other contract terms, such as collateral and maturity, to compensate for any increase in risk. This is the first paper that employs such disaggregate and detailed data to investigate changes in banks' credit policy following the introduction of an explicit government guarantee.

[1] See Demirgüç-Kunt, Kane, and Laeven (2007) for recent trends in deposit insurance adoption.

[2] Changes in loan quality are likely to capture the bulk of bank risk-taking in this case, since Bolivian banks are relatively small and unsophisticated with few off-balance sheet activities.

Because of data limitations many of the existing studies rely on bank failures or ratios of nonperforming loans to evaluate risk-taking. Both measures have several shortcomings. They are not only ex-post measures of risk (i.e., low risk loans at origination could later on default if economic conditions deteriorate), but also backward-looking, making it difficult to uncover the effect of deposit insurance on risk-taking, especially since most deposit insurance systems are introduced or modified at the onset or in response to a financial crisis.[3]

Controlling for changes in macroeconomic conditions and competition in the local loan markets, we find that after the introduction of deposit insurance banks are more likely to initiate riskier loans: loans with ratings higher than one, the best rating. As expected these loans carry higher contractual interest rates and are more likely to have overdue payments or default than loans with the best rating. We also find that banks do not adjust other contract terms, such as collateral and maturity, to compensate for the extra risk. Although riskier loans are more likely in the post-deposit insurance period, the incidence of collateral is actually lower. With respect to maturity there are no systematic differences between the two periods. These additional results strongly suggest that banks are not simply expanding their intermediation base, but are engaging in risk-shifting to the deposit insurance fund.

Apart from analyzing the credit quality decisions of banks before and after the introduction of deposit insurance, we also examine how different bank characteristics affect those decisions. We find that prior to the introduction of deposit insurance, banks with a high share of large depositors take less risk, but the effect disappears after the introduction of a system that provided all depositors with generous explicit guarantees. This result mirrors the evidence in de Dreu and Ioannidou (2006) who find that large depositors in Bolivia discipline their banks

[3] See, for example, the discussion in Gropp and Vesala (2004) and Grossman (1992).

prior to the introduction of deposit insurance, but not after. Our results also show that the banks that benefited the most from the explicit guarantee (i.e., the banks that experienced the largest drop in the cost of deposits following the introduction of deposit insurance) are those that take more risk in the second period. Finally, before the introduction of deposit insurance very large banks (those more likely to enjoy 'too-big-to-fail' guarantees) take more risk than small banks. As expected, this differential effect disappears when all banks are subject to explicit deposit insurance. This cross-sectional analysis is not only interesting in itself, but also a key component of our identification strategy.

Although the existing empirical evidence is mixed, most of the studies find that deposit insurance increases banks' risk-taking or at least provide evidence consistent with this interpretation. For example, Alston, Grove and Wheelock (1994), Grossman (1992), Wheelock (1992), and Wheelock and Wilson (1995) find a positive relationship between US bank failure rates in the 1920s and 1930s and deposit insurance. Employing put option pricing models, Havokimian and Kane (2000) find that risk-based capital requirements did not prevent large US banks from shifting risk onto the safety net, especially poorly capitalized banks and banks with high ratios of deposits to total debt.[4] Karels and McClatchey (1999), instead, find that the adoption of deposit insurance in the 1970s decreased the risk-taking of US credit unions (e.g., they had lower ratios of nonperforming loans in the post-deposit insurance period).

More recent papers examine how the design of the deposit insurance scheme and the institutional framework influence the effect deposit insurance has on banks' risk-taking. Using a sample of more than 60 developed and developing countries Demirgüç-Kunt and Detragiache (2002) find that deposit insurance increases the probability of a banking crisis, especially in

[4] This study builds on Markus and Shaked (1984), Ronn and Verma (1986), and Pennacchi (1987 a, b).

countries with weak institutional environments. Applying the put option pricing model in a cross-country sample, Hovakimian, Kane and Laeven (2003) find that the introduction of deposit insurance systems (as opposed to implicit guarantees) has had adverse effects in countries with low levels of political and economic freedom and high levels of corruption. They also find that risk-shifting is attenuated by risk sensitive premiums, coverage limits, and coinsurance. Gropp and Vesala (2004), on the other hand, find that the introduction of explicit deposit insurance in Europe reduced bank risk-taking. They argue that explicit deposit insurance may have implied a de facto reduction in the scope of the safety net by credibly excluding large subordinate debt holders from the previously implicit guarantees.[5]

This paper is organized as follows. Section II explains the institutional background and describes the Bolivian deposit insurance scheme in comparison to other countries. Data are described in Section III, while the methodology is presented in Section IV. Section V reports the results, and robustness checks are presented in Section VI. Section VII concludes.

II. Institutional background

Bolivia introduced explicit deposit insurance on December 20, 2001 with the passage of Law 2297. Before, there were some ambiguous implicit guarantees. For example, when Banco Sur and Banco de Cochabamba failed in 1994, the Bolivian Central Bank (BCB) covered 100 % of their deposits to the private sector. In more recent years, these bailout policies tended to favor small depositors and in some cases it took a long time for funds to be paid back.[6] Hence, it

[5] Before the introduction of explicit deposit insurance some European countries may have been characterized by strong implicit insurance through the expectations of public intervention at times of distress (e.g., during the Swedish and Finnish banking crises in the early 1990s all bank creditors were bailed out).

[6] For example, when a savings and loan cooperative failed in 1996, the BCB covered only up to $5,000 per account. Similarly, when Banco International de Desarrollo failed in 1997, the BCB attempted to put a limit of

would be reasonable to argue that prior to the introduction of deposit insurance, (large) depositors had reasons to discipline their banks.

In terms of its characteristics, the Bolivian deposit insurance system is very similar to the rest of the world. Participation is mandatory. There is a permanent fund, financed by insurance premiums. If the fund's resources are not enough to cover the insured amount, the BCB is required by law to provide the lacking resources, lending credibility to the newly established fund.[7] The insurance premiums are not risk-based, but simply proportional to the bank's private sector deposits. Like for most deposit insurance systems, interbank deposits are not insured and deposits in the local or foreign currency are treated equally.[8]

The only difference with respect to most deposit insurance systems is the absence of full insurance up to a certain amount per depositor/account.[9] That is, the coverage rate does not vary among accounts of different size within a given bank (as in the United States), but it varies across banks and time, depending on their liabilities structure.[10] All banks, however, have a liability structure which implies that only private sector deposits are insured, and even those are only partially covered in most cases. On average, the coverage rate of private sector deposits is 60%, ranging from 51% to 100%. Compared to the rest of the world, the Bolivian scheme is probably more generous to large depositors than other systems.

$5,000 per account. This attempt was followed by bank-runs and the BCB increased the limit to $200,000. The first $5,000 were paid in cash and the remaining part was paid using non-interest bearing certificates of deposits issued by the BCB with maturities ranging from 2 to 4 years.

[7] See third paragraph of Article 127, Law 2297.

[8] More than 90 % of deposits and credits are in U.S. dollars. This high degree of dollarization is one of the longer lasting effects of the hyperinflation of the 1980s.

[9] See, for example, Table 1 in Demirgüç-Kunt, Kane, and Laeven (2007).

[10] The fund insures only up to 50 % of a bank's "total preferred obligations" and they are divided into senior and subordinate obligations. Senior obligations consist primarily of deposits to the private sector, while subordinate obligations include obligations to the public sector, the BCB, and foreign financial entities.

This unusual feature of the Bolivian system was the result of pressure from financial institutions against the first draft of the deposit insurance law that included a coverage limit of $10,000 per account. This first draft was submitted to the Congress in 1999, but failed to pass given the strong opposition from private interest groups.[11] The lifting of the coverage limit and the banking crisis in neighboring Argentina may have helped to bring the negotiations to an end with the passage of this modified law at the end of 2001.

The efforts to introduce explicit deposit insurance, however, started in the late 1990s following pressure from the IMF and the World Bank. This was part of a more general phenomenon. During the 1990s, these supranational organizations recommended the adoption of explicit deposit insurance in many countries as a way of containing crises and limiting implicit guarantees. As a result the number of countries with explicit deposit insurance increased significantly in recent years. In 1995 only 45 countries offered explicit deposit insurance. By 2003 this number increased to 87, which amounts to a 78% increase.

III. Data

Our data source is the Central de Información de Riesgos Crediticios (CIRC), the public credit registry of Bolivia, managed by the Bolivian Superintendent. This unique database contains detailed loan contract information, on a monthly basis, on all outstanding loans granted by any bank operating in the country. The analysis focuses on commercial loans to firms and in particular on loan initiations between 1999:03 and 2003:12.[12] Analyzing only new loans (i.e.,

[11] A number of recent papers have been emphasizing the role of private interest groups on the design of deposit insurance systems around the world (see, Demirgüç-Kunt, Kane, and Laeven (2007) and Laeven (2004) for cross-country evidence, and Kroszner and Strahan (2001) for voting behavior in the U.S. House of Representatives).

[12] Prior to 1999:03 we cannot distinguish between commercial and consumer loans.

"fresh loans") allows us to uncover the effect of deposit insurance on contemporaneous risk-taking. This yields 51,418 loan initiations to 4,463 firms.

For the analysis we focus on standard debt contracts ("plain vanilla" loans), such as installment and discount loans, for which origination in a given period is a decision of the bank (this might not be the case for overdrafts which reflect the moment the borrower draws on the authorized amount) and the likelihood of repayment is mostly firm-specific (not transaction-specific as in the case of discount documents, for example). The resulting sample includes 31,374 loans to 2,647 firms. These contracts account for 92% (61%) of the total dollar value (number) of loan initiations to firms during the sample period.

Table 1 describes our variables and Table 2 provides summary statistics with respect to three key aspects of our dataset: loans characteristics (Panel A), bank characteristics (Panel B), and macroeconomic conditions (Panel C). As can be observed in Panel A, 53% of the loans in our sample are discount loans and the remaining 47% are installment loans. 98% are denominated in US dollars, and the median loan size is US$ 44,000. The median interest rate on loans denominated in US dollars (Bolivianos) is 14% (16%). Only 25% of loans are collateralized and the median loan maturity is 6 months. At origination, the average loan has a credit rating of 1.17. The loan officer determines these ratings when a loan is issued, and they range between 1 (best) and 5 (worst), reflecting the *borrower's* repayment capacity as perceived by the bank when the loan is originated.[13] At origination, 10% of the loans in our sample have a rating of 2 and 3% have ratings higher than 3.

[13] All banks use the same rating scale determined by the regulatory authority. A rating of 1 is given to borrowers with sound fundamentals (i.e., borrowers with the capacity to repay their loan obligations in full). A rating of 2 is given to borrowers with potential but temporary problems (i.e., borrowers that may experience or may have already experienced difficulties in paying part of their obligations, but are nevertheless expected to repay their debt in full). A rating of 3 is given to borrowers with financial weaknesses (i.e., borrowers that at the time of evaluation

Approximately 71% of loans are given to corporations, 14% to partnerships, 13% to sole proprietorships and 2% to public companies, municipalities, and civil associations. In terms of industry, 31% of our loans are in the manufacturing sector, 29% are in the retail sector, and 11% in construction. Although not reported in the Table, the firm composition with respect to legal structure, size, and industry, is very similar to the Survey of Small Business Finances used in Petersen and Rajan (1994), for example.[14]

With respect to market concentration, the median loan is drawn from a relatively competitive market with a Herfindahl-Hirschman Index (HHI) equal to 1,600. The HHI is calculated with the number of loans outstanding for each of the nine Bolivian provinces. In the urban regions (La Paz, Cochabamba, and Santa Cruz) where 92% of loans are originated, the HHI ranges between 1,200 and 1,900. The remaining six rural regions are more concentrated. Overall, the median HHI is 3,500, ranging between 1,900 and 9,900.

In Panel B of Table 2 we present descriptive statistics for some key bank characteristics. The median bank in Bolivia has US$ 331 million of total assets. The largest bank (Banco Santa Cruz) has 1.4 billion US$ of total assets and represents around 25% of total bank assets in the beginning of the sample period.[15] The median bank in our sample has an equity to total

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have insufficient earnings to repay their debt). A rating of 4 is given to borrowers with income flows that are not enough to repay their debt in full. A rating of 5 indicates the default status. It is given when a borrower is considered insolvent. The ratings reflect the borrower's repayment capacity and not the loan's. At a given point in time, loans to the same borrower within the same bank have the same rating, but they can have different ratings across banks. The latter is true for 19% of the 31,374 loan initiations in our sample. When looking only at loan originations, however, we find no differences across banks, suggesting that differences across banks might be due to sluggish adjustment of ratings on outstanding loans. For 67% of the initiations in our sample there was another initiation to the same borrower in the same month, 9% of which involved a different bank. For these cases, there were no differences in the ratings.

[14] Ioannidou and Ongena (2008), who use this database for the first time, provide detail information about firm composition by industry, size, legal structure and number of bank-firm relationships. It should be pointed out, however, that their sample is slightly different from ours. For example, because they study the loan conditions when firms switch banks they only analyze loans from firms with a prior "inside" loan.

[15] During the sample period there are twelve commercial banks operating in Bolivia, some of which are foreign owned: Banco Santa Cruz (foreign subsidiary), Banco Nacional de Bolivia, Banco Industrial, Banco Mercantil, Banco de la Unión, Banco de Crédito de Bolivia (foreign subsidiary), Banco Económico, BHN Multibanco, Banco

assets ratio of 10.9%, a non-performing loans to total assets ratio of 8.5%, a loan loss reserves to total assets ratio of 4%, an annualized return to total assets ratio of 0.5%, a ratio of liquid assets to total assets of 5%, an annualized interest rate of savings deposits (denominated in US$) of 3%, and a median long-term credit rating of A+. As can be seen in Table 2 all bank characteristics present considerable time-series and cross-sectional variation.

In Panel C of Table 2 we provide some information about the macroeconomic conditions during the sample period. The average annual growth rate of the real GDP is 2.2%, ranging from 0.72% to 3.7%. Prices were quite stable with an average inflation rate of 2.5%, very similar to the U.S. inflation rate, but with more variation. Because the economy is so highly dollarized, the exchange rate follows a crawling peg with the US dollar. During the sample period, the exchange rate has been depreciating at a roughly constant rate of 6.9% per annum, ranging between 5.7 and 7.8 Bolivian Pesos per US dollar. The average interest rate on 3-month Bolivian Treasury Bills (denominated in US$) is 5%, ranging between 1% and 9.4%.

We also include the composite country risk indicator from the International Country Risk Guide (ICRG). This indicator is available on a monthly frequency and it encompasses political, financial, and economic risks. According to the ICRG, a value of zero indicates high risk, while a value between 80 and 100 indicates very low risk. During the sample period, this indicator ranged between 65 and 70, with both minimum and maximum values corresponding to months before the introduction of deposit insurance. To capture the conditions of the banking sector we also include the ratio of nonperforming loans to total bank assets for the banking system as a whole. On average this ratio is 8%, ranging from 2% to 17%.

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de La Paz, Banco Ganadero, Banco Solidario, Citibank (foreign branch), Banco de la Nación Argentina (foreign branch), ABN Amro (foreign branch), Banco do Brasil (foreign branch).

Figure 1 describes the time-series pattern of the growth rate of real GDP. Before the introduction of deposit insurance the growth rate shows big fluctuations, with growth rates near zero around the end of 1999. Starting four months before the introduction of deposit insurance, the growth rate of real GDP follows a stable and increasing trend, with a peak of 3.9% in July 2003. This time-series pattern indicates that the introduction of deposit insurance did not coincide with a period of increased macroeconomic uncertainty.

IV. Methodology

A. Baseline model

We begin by investigating whether the probability of initiating risky (or subprime) loans is affected by the introduction of deposit insurance. Our key independent variable is the deposit insurance dummy, *DI*, which equals 1 after December 2001 (when the deposit insurance was introduced) and 0 otherwise. To identify whether a loan is risky we use the bank's internal rating for each loan at the time of origination. Loans with a rating higher than 1 (the best rating) are considered risky or subprime.

For the analysis we use two alternative dependent variables: *Subprime*_1 and *Subprime*_2. *Subprime*_1 takes the value of 1 if at origination a loan has a credit rating higher than 1, and 0 otherwise. Similarly, *Subprime*_2 takes the value of 1 if at origination a loan has a credit rating higher than 2, and 0 otherwise. Before turning to the description of our control variables, we investigate how these ratings and our definitions of subprime loans relate to loan interest rates at origination and ex-post performance.

In Panel A of Table 3 we regress the loan rate on the credit ratings, controlling for currency denomination, and time effects using month/year dummy variables. Loans with

ratings equal to 2 have interest rates that are 51 basis points higher than the rates on loans with ratings equal to 1. Similarly, loans with ratings equal to 3, 4, and 5 have interest rates that are 161, 184, and 481 basis points above the rates of loans with rating equal to 1, respectively. Interest rates jump from a rating of 3 and above, suggesting that *Subprime*_2 might be capturing loans that are significantly riskier. There are, however, 109 loans issued with a rating of 5 (i.e., they are at the default status at origination). Since we fear that such loans might be the result of accounting procedures, not necessarily related to current risk-taking, we dropped them from our sample. All results presented from now on do not include these loans.[16]

Panel B of Table 3 investigates the relationship between our definitions of subprime loans and ex-post performance. To evaluate a loan's ex-post performance we use two criteria: whether sometime after origination there are overdue payments for more than 30 days (non-performing) and whether the loan has been downgraded to 5 (default). Both definitions of subprime loans are positively correlated with ex-post non-performance. 40% of loans that have been flagged as risky by *Subprime*_1 had overdue payments and 6% defaulted, while only 14% of those that have *not* been marked as risky had overdue payments and only 1% defaulted ("Type I error"). As expected, *Subprime*_2 is a better predictor of ex-post problems: 66% of loans that were marked as risky by *Subprime*_2 had overdue payments and 18% defaulted. Both definitions, however, have similar Type I errors.

Finally we also examine whether the default probabilities associated with each rating changed after the introduction of deposit insurance. We want to make sure that any effects of *DI* on the probability of initiating riskier loans are *not* due to changes in the way banks are assigning their ratings. For example, if controlling for macroeconomic conditions each rating

[16] Including these loans in our sample does not qualitatively alter our results.

is associated with a lower probability of default when *DI* = 1, finding that *DI* is associated with a higher probability of initiating loans with a worse rating would not necessarily imply that banks are taking more risk. To investigate this possibility we estimate a proportional hazard model on the probability of default in period *t*, conditional on surviving until then.[17] Our key explanatory variables are four dummy variables, one for each rating, and their interactions with *DI*. The results, presented in Panel C of Table 3, show that there are no systematic changes in the relationship between the probability of default and the credit ratings.

All in all, these results suggest that using the credit ratings to investigate ex-ante risk-taking is a reasonable empirical strategy. Banks are charging higher interest rates on loans they mark as risky, those loans are associated with worse ex-post performance, and there are no systematic changes on the way banks assign their ratings before and after the introduction of deposit insurance, at least as far as ex-post performance measures suggest.

We now turn to our control variables and explain the rationale behind them. Our objective is to capture the effect of explicit guarantees on banks' risk-taking. Therefore we should control for changes in macroeconomic conditions that might affect the pool of applicants. We should also control for changes in local market conditions. Broecker (1990), for example, shows that competition decreases the average quality of the pool of applicants, suggesting that banks in more competitive markets are on average more likely to initiate riskier loans because they face a riskier pool. We control for such changes using the HHI at the regional level. To make sure that *DI* is capturing a structural break, and not a trend, we also

[17] The hazard function, $\lambda(t)$, is equal to $\lambda_0(t)\exp(\beta' X_t)$, where *t* measures the number of months since the loan was originated, $\lambda_0(t)$ is the baseline hazard function, and $\hat{\beta}$ reflects the partial impact of each variable on the log of the estimated hazard rate. For $\lambda_0(t)$ we assume a Weibull specification: $\lambda_0(t) = \lambda\alpha t^{\alpha-1}$. Our estimates suggest that $\hat{\alpha}$ is equal to 2.40, indicating positive duration dependence.

add a time trend among our control variables.[18] This yields our benchmark specification. To explore whether the effect of deposit insurance (if any) is driven by a few risky banks issuing a larger proportion of loans after the introduction of deposit insurance, we augment this specification by introducing bank fixed effects, exploiting only within-bank variation. Bank fixed effects could also be capturing possible differences among banks on the criteria they use to determine their ratings— this, however, is not expected to have a first order effect since as mentioned earlier such differences are relatively rare.

B. Cross-sectional identification strategy

Data availability allows us to analyze not only the risk-taking behavior of banks before and after deposit insurance, but also how different *bank* characteristics might affect this behavior. We believe that such cross-sectional analysis (apart from being interesting in itself) is a key component of our identification strategy.

1. Share of large deposits

Economic theory and existing empirical evidence suggests that market discipline in the deposit market comes mainly from large depositors.[19] In general, large depositors have more at stake, they are more sophisticated, and they expect to gain less from ex-post bailout policies as governments often impose coverage limits per account.

Using data from Bolivia, de Dreu and Ioannidou (2006) found that prior to the introduction of deposit insurance large depositors were disciplining their banks by withdrawing

[18] Advances in information technology such as credit scoring, for example, might increase the willingness of banks to service the subprime market (see, for example, Adams, Einav and Levin (2007)).

[19] See, among others, Dewatripont and Tirole (1994), Diamond and Dybvig (1983), Ellis and Flannery (1992), Flannery and Sorescu (1996), Park and Peristiani (1998), and Martinez Peria and Schmukler (2001).

their deposits from riskier banks. Their responsiveness decreased significantly after the introduction of deposit insurance, which granted all depositors (regardless of their size) a generous explicit guarantee. Taking these results at face value, one would expect that prior to the introduction of deposit insurance banks with a high percentage of large deposits are taking less risk. This effect should be significantly reduced or even completely eliminated after the introduction of deposit insurance in December 2001.

To test this hypothesis, we introduce the share of large deposits on total deposits. Table 4 describes the composition of deposits by size. For the average bank, 92% of the dollar value of total deposits comes from accounts with at least US$ 5,000, 76% comes from accounts with at least US$ 30,000, while only 44% comes from accounts with at least US$ 200,000. The composition of deposits by size is relatively stable over time. There is, however, considerable cross-sectional variation for thresholds higher than US$ 5,000. At sample entry, there are banks with 60% of their deposits from accounts with at least US$ 30,000 and banks with a corresponding value of 91%. For the analysis we use the US$ 30,000 threshold for large deposits, but in the robustness section we experiment with alternative thresholds.

2. Too-big-to-fail

Larger bank size leads to increases in the potential systemic risk an institution can trigger if it experiences credit or liquidity problems. Hence, most governments adhere to too-big-to-fail policies, protecting the uninsured debt-holders of large insolvent banks whose failure could trigger contagion in the financial system. To attenuate the resulting moral hazard problem most governments either claim that such policies do not exist or use the "constructive ambiguity" approach. In such a context investors are ex-ante uncertain about whether and which banks will be bailed out, but everything else equal, the larger the bank the more likely it is to be deemed as "too-big-to-fail".

These implicit guarantees may limit the risk-sensitivity of banks' cost of funds and therefore lead them to optimally take more risk.[20] If too-big-to-fail guarantees were present in Bolivia, we would expect very large banks (those deemed too-big-to-fail) to take more risk than smaller banks. However, because deposit insurance introduced explicit guarantees on all banks regardless of their size, this effect should be significantly reduced or even completely eliminated after December 2001. Since ex-ante it is always difficult to determine the too-big-to-fail threshold, estimate this threshold we introduce in our specifications both a linear and a non-linear term for bank size, *Log*(*Assets*) and *Log*(*Assets*)*_Square*.

V. Results

A. Baseline model

Table 5 reports the results of the baseline model. For each specification we report the estimated coefficients from a probit model, their standard errors, and their significance levels. Models I and III report specifications for *Subprime*_1 and *Subprime*_2, respectively. We control for changes in macroeconomic conditions and competitive conditions in the local loan markets as well as the time trend. All macroeconomic controls are included with a lag of one month (the same holds for all future specifications). In Models II and IV we also add bank fixed effects. In all cases the standard errors are clustered at the firm level.

The estimated coefficients of *DI* are always positive and statistically significant, suggesting that after the introduction of deposit insurance, banks are more likely to initiate riskier loans. The marginal effects of the estimated coefficients of Models I and II suggest that

[20] Penas and Ünal (2004), for example, find evidence of a too-big-to-fail effect on the cost of bank debt. They compare bond yields at issue before and after a bank merger, and find a significant decrease in spreads only for the

the probability of issuing *Subprime*_1 loans increases by 6.8% and 6.0%, respectively. Given that the predicted probabilities of *Subprime*_1 loans are only 12.3% in Model I and 11.8% in Model II (i.e., there are relatively few of them), the likelihood of these loans in the second half of the sample increases by more than 56%. Similarly, the probability of *Subprime*_2 loans increases by 1.8% in Model III and 1.4% in Model IV, which in percentage terms they amount to a 66% and 64% increase, respectively. The estimated coefficient of *DI* does not change a lot when bank fixed effects are included in the specifications, suggesting that this coefficient is mainly driven by variation over time within each bank.

With respect to the control variables, the growth rate of real GDP has a negative and statistically significant coefficient, suggesting that the pool of applicants is better when macroeconomic conditions are better. As expected, the estimated coefficient of the regional HHI is always negative and statistically significant for *Suprime*_2, suggesting that competition in the local loan markets decreases the average quality of the applicant pool, consistent with Broecker (1990). Interestingly, the coefficient of the aggregate nonperforming loans ratio is always negative, and statistically significant in three out of four specifications, consistent with banks being more cautious or facing more regulatory pressure when portfolios deteriorate. The estimated coefficient of the time trend is always negative and it is statistically significant only in the *Subprime*_1 specifications. The same holds for the coefficient of market interest rates. Finally, the coefficients of the Bolivian inflation rate and the ICRG composite country risk indicator are not statistically significant, possibly because their effect is absorbed by some of our other macroeconomic controls.

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group of banks that were able to push the asset size above the too-big-to-fail threshold after the merger.

Our findings suggest that banks are more likely to initiate riskier loans after the introduction of deposit insurance. Although this is consistent with more risk-taking in response to the introduction of deposit insurance, it is possible that our controls do not adequately capture all possible time-series changes that might be correlated with *DI*. Hence, we now turn to our cross-sectional analysis and examine whether the effect of selected bank characteristics is consistent with the interpretation of our results.

B. Cross-sectional identification strategy

The share of large deposits on total deposits, *Share of Large Deposits*, and the nonlinear term for bank size, *Log*(*Assets*)_*Square*, are our key explanatory variables. If deposit insurance is behind our findings, these variables should have very specific (and different) effects before and after the introduction of deposit insurance.

Instead of introducing interaction terms between our key explanatory variables and *DI,* we take a more conservative approach allowing all coefficients to vary by splitting the sample in two periods: before and after deposit insurance. Since most of the variation in the key variables is cross-sectional we replace the bank fixed effects with time-varying bank characteristics. Before doing this, however, we re-estimate our baseline model using the new set of controls.[21] The results, presented in Table 6, Columns I (for *Subprime*_1) and IV (for *Subprime*_2), are very similar to those presented earlier. In both cases, *DI* has positive and statistically significant coefficients.

[21] In these specifications we do not include the banking system's ratio of nonperforming loans since it is highly correlated with its bank-level counterpart. The correlation between the two variables in our sample is 0.77.

In the remaining part of Table 6 were report our findings for the two sub-periods (see Columns II-III for *Subprime*_1 and Columns V-VI for *Subprime*_2). Regardless of which definition of subprime loans is used the results are qualitatively very similar.

For the first period, the *Share of Large Deposits* has a negative and statistically significant coefficient, consistent with large depositors disciplining their banks prior to the introduction of deposit insurance. In terms of economic significance, an increase in the *Share of Large Deposits* by one standard deviation (11%), reduces the probability that a bank will initiate a subprime loan by 5.3% for *Subprime*_1 and 1% for *Subprime*_2, which imply a decrease in the likelihood of subprime loans by 40% and 46%, respectively.[22] These effects disappear after the introduction of a system that provides depositors with generous explicit guarantees (i.e., in both cases, the *Share of Large Deposits* has positive and insignificant coefficients with p-values equal to 0.62 and 0.98, respectively).

The results are also consistent with a too-big-to-fail effect prior to the introduction of deposit insurance. We find that large banks are less likely to initiate riskier loans, but very large banks (those that tend to be subject to too-big-to-fail guarantees) are taking more risk. Our estimates suggest that the too-big-to-fail effect kicks in for market shares larger than 18.2%. After the introduction of deposit insurance (that granted explicit guarantees to *all* banks) this effect disappears. Both *Log*(*Assets*) and *Log*(*Assets*)*_Square* have statistically insignificant coefficients. It should be pointed out, however, that removing the non-linear term from the regression yields a positive and statistically significant coefficient for *Log*(*Assets*), suggesting that what disappears is the non-linearity.[23]

[22] The corresponding predicted probabilities are 13.2% and 2.3%, respectively.

[23] To save on space these results are not reported in the paper, but are available upon request.

It should be pointed out that there is only one bank (out of 12) with a market share above 18%. This is not surprising as one would expect that only a small percentage of a country's banking sector would qualify for too-big-to-fail guarantees. Nevertheless, these results should be viewed with caution. Even if we are drawing from several thousands of loans that this bank issued during the sample period, they are still describing the behavior of one bank. Hence, it is possible that we are capturing something idiosyncratic about this bank and not a too-big-to-fail effect that disappeared after the introduction of deposit insurance.[24]

There are also some interesting results with respect to some other bank characteristics which are mainly used as control variables. Prior to the introduction of deposit insurance, banks with higher capital ratios (i.e., banks whose stockholders have more to lose in the event of a bank-run) are taking less risk. Contrary to our expectations this effect is not only attenuated, but is completely eliminated in the post-deposit insurance period.[25] Controlling for bank capital, banks with worse portfolios (with more non-performing loans and lower loan loss reserves with respect to their size) are taking less risk in the first part of the sample. The effect reverses in the second half: with deposit insurance, banks with worse portfolios are more likely to issue subprime loans, consistent with theoretical predictions (Merton (1977)).

A key driving force behind these findings could be the reduction in depositor discipline following the introduction of deposit insurance. In particular, de Dreu and Ioannidou (2006) found that prior to the introduction of deposit insurance deposit rates in Bolivia were sensitive to bank-risk, but not afterwards. For example, a AAA-bank paid no more than 2.5% for its (U.S.$ denominated) savings deposits, while a BBB- or a BBB-bank paid at least 4.5%. The

[24] A coincidence is always more likely for one bank rather than a group of banks.

[25] Models of deposit insurance suggest that banks with lower capital ratios have more incentives to take advantage of the deposit insurance subsidy by taking on more risk (see, for example, Merton (1977)).

correlation between the rates on savings deposits and bank ratings was 0.76.[26] Afterwards, no bank paid more than 2.5% for their savings deposits and the correlation dropped to -0.09.

Hence, if the reduction in depositors discipline is what spurs the increase in risk taking in the second period, we should also observe that the banks that experienced the largest drop in their cost of funds (i.e., the riskiest banks that benefited the most from the introduction of deposit insurance) are those that are taking more risk in the second period. To capture the cross-sectional differences in the *drop of the cost of deposits* we take the difference between a bank's average rate on savings deposits in the six months prior to introduction of deposit insurance and the average rate in the subsequent six months.[27] Using the change of deposit rates around that time allows us to abstract from other factors the may also affect the level of interest rates (such as market rates, market competition, and bank efficiency).

Next, using a specification similar to our benchmark we examine whether this new variable is positively correlated with the probability of granting a subprime loan in the second period. The model is estimated for a sub-sample starting seven months after the introduction of deposit insurance until the end of the sample (so that our key explanatory variable is predetermined). The results are presented in Table 7. As expected the drop in the cost of deposits has a positive and statistically significant coefficient. This effect is also economically relevant since a one percent decrease in the cost of deposits is associated with a 24% (26%) increase in the incidence of *Subrpime*_1 (*Subprime*_2) loans.

[26] To calculate correlations we use a categorical variable by mapping the ratings into numerical values as follows: AAA = 1, AAA- = 2, AA+ = 3, AA = 4, ..., C = 25.

[27] The drop in the cost of deposits equals on average 2.03%, has a standard deviation of 1.28%, a minimum value of 0% (from a AA-bank), and a maximum of 3.98% (from a bank with a BBB-). The correlation between this variable and bank ratings is 0.51 (the correlation is again calculated using the categorical variable).

C. Contract terms

Our findings point to a significant increase in risk-taking after the introduction of deposit insurance, based on evidence that relies on the credit ratings assigned by banks when loans are originated. As mentioned earlier, these ratings are borrower-based rather than loan-based, reflecting the borrower's capacity of repayment. This implies that banks do not take into account contract terms, such as collateral and maturity when determining these ratings. Hence, it is possible that while banks are originating riskier loans after the introduction of deposit insurance, they are also compensating for that extra risk by requiring collateral or shortening maturities. Requiring collateral not only reduces the losses when default occurs, but it also mitigates agency problems by reducing incentives to shift risk (see, for example, Boot, Thakor, and Udell (1991) and Boot and Thakor (1994)).[28] Similarly, shorter maturities may be useful in addressing information problems by forcing more frequent information disclosure and renegotiation of contract terms (see, for example, Graham, Li, and Qiu (2007) and Ortiz-Molina and Penas (2006)). Hence, in this section we explore whether such compensating mechanisms play a more important role after the introduction of deposit insurance.

We begin by investigating whether the probability of pledging collateral increases systematically after the introduction of deposit insurance. Results are reported in Table 8. Column I presents a specification similar to our baseline model (i.e., with the same set of controls). Surprisingly, after the introduction of deposit insurance the probability of pledging collateral falls by 12% (which implies a 53% decrease in the incidence of collateral), suggesting that banks not only do not compensate their increase in risk-taking by requiring collateral more often, but they require collateral less often.

Next, we investigate the relationship between collateral and risk both before and after the introduction of deposit insurance by adding the credit ratings in our specifications and splitting the sample in the two periods (Columns II and III respectively). We find that before the introduction of deposit insurance, riskier loans are more likely to be collateralized. Loans with rating equal to 3 (4) are 7% (14%) more likely to be backed by collateral than loans with rating equal to 1. After the introduction of deposit insurance, loans with rating equal to 2 as opposed to 1 are more likely to have collateral pledged. This is not true, however, for the more risky categories (3 and 4), which became more likely in the post-deposit insurance period.

We undertake a similar exercise for loan maturity. The results are presented in Columns IV (for the entire period), Column V (before deposit insurance), and VI (after deposit insurance). We find that loan maturity is not affected by the introduction of deposit insurance, perhaps because maturities in Bolivia are already so short that there is no room for further decrease—the median loan maturity in our sample is only 6 months.

All in all, these results indicate that banks do not use other contract terms such as collateral or maturity to compensate for their increased risk-taking.

D. Bank-level analysis

Using loan initiations and ratings at origination allows us to uncover the effect of deposit insurance on *contemporaneous* and *ex-ante* risk-taking. This is the main advantage of our loan-level analysis. A complete assessment of risk-taking, however, requires an ex-post analysis at the portfolio level, since imperfect correlation of loan performance reduces portfolio

[28] In addition, collateral requirements allow lenders to sort observationally equivalent loan applicants (see, for example, Besanko and Thakor (1987a, 1987b) and Bester (1985)).

risk. Hence, we complement our loan-level analysis by examining the traditional bank balance-sheet measure of nonperforming loans used in the literature.[29] Controlling for bank fixed effects and macroeconomic factors, we find that the ratio of nonperforming loans to total assets (total loans) is systematically higher by about 3.7% (6.7%) after the introduction of deposit insurance, consistent with our previous findings. Due to space constraints these results are not reported in the paper, but they are available upon request.

VI. Robustness checks

We undertake two additional exercises. First, we investigate the robustness of our findings with respect to the *Share of Large Deposits* using alternative thresholds. Results are reported in Table 9. In Models I-II and V-VI we define large deposits as accounts with more than US$ 5,000 and in columns III-IV and VII-VIII we use a threshold of US$ 50,000. Consistent with the previous results for a threshold of US$ 30,000, the *Share of Large Deposits* decreases the probability of issuing a subprime loan before the introduction of deposit insurance, but has no effect on bank risk-taking afterwards.

We also add to the baseline model of Table 5, loan-level characteristics. We control for contract type, currency denomination, firm type, industry, and region. Even after controlling for these factors, the coefficient of *DI* is positive and statistically significant, suggesting that the increase in risk-taking was not concentrated in a particular industry, region, firm type, or currency denomination. In terms of economic significance the effects are similar to those found earlier. Deposit insurance is associated with an increase in the probability of

[29] See, among others, Gropp and Vesala (2004), Grossman (1992), and Karels and McClatchey (1999).

*Subprime*_1 (*Subprime*_2) by 7.1% (2.5%), which implies an increase in the incidence of *Subprime*_1 (*Subprime*_2) loans by 64% (89%).[30]

VII. Conclusions

We examine the effect of the introduction of deposit insurance on the credit quality of banks' loans. In particular, we analyze the case of an emerging economy that experienced a dramatic regulatory change in December 2001, from a system with ambiguous implicit guarantees to a system with partial deposit insurance, which covers a fraction of all deposits independently of their size. Our main results show that the introduction of deposit insurance led to an average increase of 7% in the probability of originating a subprime loan. Contract terms, such as collateral and maturity, do not appear to compensate for the extra risk. Although riskier loans are more likely in the second period, the incidence of collateral is lower and there is no systematic change in loan maturity, suggesting that banks are engaging in risk-shifting.

The results of our cross-sectional analysis are also consistent with this interpretation. Banks with a high share of large depositors take less risk before the introduction of deposit insurance, but the effect disappears after the introduction of a system that provided all depositors with generous explicit guarantees, suggesting that the increase in risk-taking might be due to a decrease in market discipline. Similarly, banks that benefited the most from the explicit guarantee (i.e., banks that experienced the largest drop in the cost of deposits following the introduction of deposit insurance) are those that take more risk in the second period. Our findings also suggest that differences between large (too-big-to-fail) and small banks diminished in the post-deposit insurance period.

[30] These results are not reported in the paper, but are available upon request.

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FIGURE 1: GROWTH RATE OF REAL GDP

This figure describes the time series pattern of the growth rate of real GDP in Bolivia between March 1999 and December 2003. The vertical line indicates when deposit insurance was introduced.

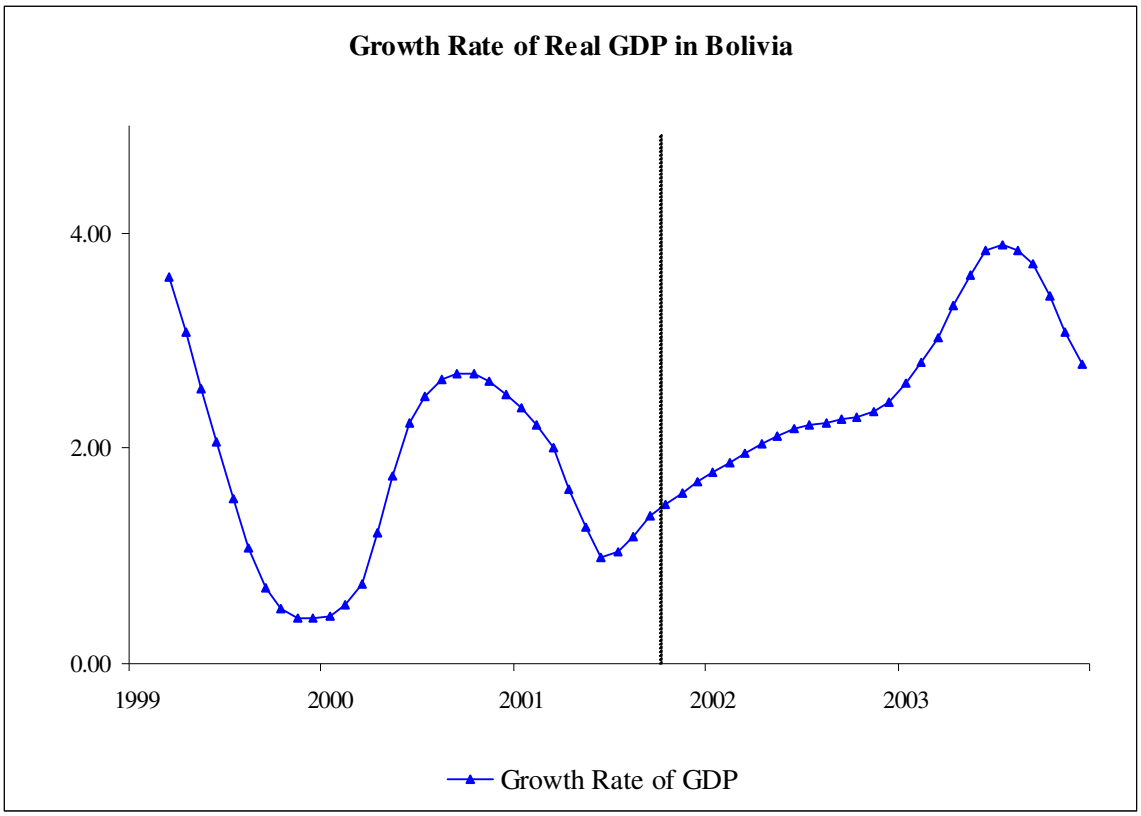

TABLE 1: DEFINITIONS AND NOTATION

The table reports the notation, definition and possible values of the variables used in the analysis.

Variables	Definition / Possible Values
A. Loan/Firm/Market Characteristics	
Loan Type	Installment, Single-Payment, Credit Card, Overdraft
Currency of Denomination	Bolivian Pesos, US Dollars
Contract Amount	Contract amount in thousands of US Dollars
Interest Rate	Annualized loan rate
Credit Rating	No Problems (=1), Potential Problems, Unsatisfactory, Doubtful, Write off (= 5)
Collateral	=1 if the loan is collateralized and =0 otherwise
Maturity	Number of months between initiation and maturity
Legal Structure	Sole proprietorships; Partnerships (i.e., all or some partners have unlimited liability); Corporations (i.e., all partners have limited liability); Other (includes public companies, municipalities, social, cultural, sport, and religious associations)
Region	Chuquisaca, La Paz, Cochabamba, Oruro, Potosi, Tarija, Santa Cruz, Beni, Pando.
Industry	Agriculture and cattle farming; Forestry and fishery; Extraction of oil and gas; Minerals; Manufacturing; Electricity, gas, and water; Construction; Wholesale and retail trade; Hotels and restaurants; Transport, storage, and communications; Financial intermediation; Real estate activities; Public administration, defense, and compulsory social security; Education; Communal and personal social services; Activities of households as employees of domestic personnel; Activities of extraterritorial organizations and bodies; Other activities
Herfindahl-Hirschman Index	The sum of squared bank shares of outstanding loans calculated per month for each region
B. Bank Characteristics	
Capital Ratio	Equity to total assets
Nonperforming Loans Ratio	Nonperforming loans to total assets
Loan Loss Reserves Ratio	Loans loss reserves to total assets
Profitability	Profits to total assets
Liquidity Ratio	Liquid assets to total assets
Log(Assets)	Log of total assets. Total assets are in millions of US$
Market Share	Bank assets over total assets of the banking system
Interest Rate on Deposits	Annualized interest rate on savings deposits denominated in US$
Bank Rating	Long-term credit rating by Duff & Phelps, Fitch, Moody's Latin America, PCR Pacific, and Thomson Financial. These ratings are available from 2000:03
C. Macroeconomic controls	
Bolivian GDP growth	Annual growth rate of the Bolivian real gross domestic product (deflated using the GDP deflator)
US Inflation rate	Annual percentage change in the US consumer price index
Bolivian Inflation Rate	Annual percentage change in the Bolivian consumer price index
Exchange Rate Change	Annual change in the Bolivian Pesos/US Dollar parity
Market Interest Rate	Annualized interest rate on 3-month Bolivian Treasury Bills denominated in US$
Country Risk Indicator	ICRG country risk indicator encompassing political, financial, and economic risk in the month prior to the loan initiation
Aggregate Nonp. Loans Ratio	Total nonperforming loans in banking system to total assets in the banking system

TABLE 2: DESCRIPTIVE STATISTICS

The table reports the mean, the standard deviation, the median, the minimum, and the maximum values for selected loan, firm, market, and bank characteristics as well as indicators of macroeconomic conditions. For loan, firm, and market characteristics the unit of observation is the number of loans, for the bank characteristics is the number of bank-month observations, and for the macroeconomic conditions is the number of months.

	obs	mean	st. dev.	median	min	max
Loan/Firm/Market Characteristics						
Installment	31,374	0.47	0.50	0.00	0.00	1.00
Single-payment	31,374	0.53	0.50	1.00	0.00	1.00
Denominated in U.S.$	31,374	0.98	0.13	1.00	0.00	1.00
Contract Amount (in thousands of US$)	31,374	164.16	473.62	44.00	0.00	12212.81
Interest Rate	31,374	13.62	2.90	14.00	0.01	35.00
Loans denominated in US$	31,374	13.59	2.84	14.00	0.01	35.00
Loans denominated in Bolivian Pesos	31,374	15.38	5.00	16.00	1.00	33.00
Credit Rating	31,374	1.17	0.51	1.00	1.00	5.00
Credit Rating_1	31,374	0.87	0.34	1.00	0.00	1.00
Credit Rating_2	31,374	0.10	0.30	0.00	0.00	1.00
Credit Rating_3	31,374	0.02	0.15	0.00	0.00	1.00
Credit Rating_4	31,374	0.004	0.064	0.00	0.00	1.00
Credit Rating_5	31,374	0.003	0.059	0.00	0.00	1.00
Collateral	31,374	0.25	0.43	0.00	0.00	1.00
Maturity (in months)	31,374	10.96	16.55	5.90	0.00	180.43
Sole Proprietorships	31,374	0.13	0.33	0.00	0.00	1.00
Partnerships	31,374	0.14	0.35	0.00	0.00	1.00
Corporations	31,374	0.71	0.45	1.00	0.00	1.00
Manufacturing	31,374	0.31	0.46	0.00	0.00	1.00
Retail	31,374	0.29	0.46	0.00	0.00	1.00
Construction	31,374	0.11	0.31	0.00	0.00	1.00
Herfindahl-Hirschman Index	31,374	0.18	0.08	0.16	0.12	0.99
Bank Characteristics						
Equity to Total Assets	715	14.35	9.03	10.90	5.14	58.13
Nonperforming Loans to Total Assets	715	9.69	6.93	8.53	0.60	41.60
Loan Loss Reserves to Total Assets	715	5.37	3.99	4.19	0.49	21.61
Return on Total Assets	715	-0.43	6.99	0.51	-114.32	48.50
Liquid Assets to Total Assets	715	6.66	5.38	5.20	0.94	43.74
Total Assets (in millions of US$)	715	380.31	287.66	331.35	15.11	1437.32
Market Share (in terms of Total Assets)	715	8.11	5.88	6.38	0.31	25.82
Interest Rate on Deposits	678	3.02	2.04	3.04	0.01	7.00
Bank Rating	546	A	.	A+	C	AAA
Macroeconomic Controls						
Bolivian GDP growth	58	2.17	0.71	2.26	0.72	3.74
US Inflation rate	58	2.45	0.75	2.33	1.07	3.70
Bolivian Inflation Rate	58	2.47	1.56	2.50	-1.23	6.42
Exchange Rate	58	6.69	0.66	6.61	5.68	7.77
Exchange Rate Change	58	0.43	0.11	0.40	0.27	0.67
Market Interest Rate	58	5.01	2.27	4.98	1.16	9.41
Country Risk Indicator	58	67.29	1.13	67.50	64.80	69.80
Aggregate Nonperforming Loans Ratio	58	7.87	4.16	7.17	2.03	16.55

TABLE 3: LOAN INTEREST RATES, RATINGS, AND EX-POST PERFORMANCE

In Panel A we regress the loan rates on credit ratings, controlling for currency denomination and time effects using month/year dummy variables. We report two specifications: one with all loans (column I) and one where loans with rating equal to 5 are excluded (column II). In Panel B we report the percentage of loans that at initiation have or have not been marked as subprime and later on had or did not have repayment problems. In Panel C we estimate a proportional hazard model of the probability of default in a given month, conditional on surviving until then. For the baseline hazard we use the Weibull distribution. This model is estimated excluding loans with rating=5 at origination. All bank and macro controls are used with a lag of one month. The models in Panel A are estimated using Ordinary Least Squares (OLS), while the model in Panel C is estimated using Maximum Likelihood (ML). In all cases, the standard errors of the reported coefficients are clustered at the firm level and are reported between brackets. ***, **, and * indicate significance at the 1%, 5%, and 10%, respectively.

A. Pricing

	I		II	
Constant	16.232 ***	[1.122]	16.238***	[1.122]
Credit Rating_2	0.514 ***	[0.120]	0.512***	[0.120]
Credit Rating_3	1.61 ***	[0.255]	1.608***	[0.255]
Credit Rating_4	1.849 ***	[0.423]	1.848***	[0.424]
Credit Rating_5	4.811 ***	[0.495]		
Number of Observations	31,374		31,265	
R-square	0.29		0.29	

B. Credit Ratings and Ex-Post Performance

		Nonperforming		Default	
		Yes	No	Yes	No
Subprime_1:	Yes	40.43	59.57	6.10	93.90
	No	14.01	85.99	0.89	99.11
Subprime_2:	Yes	66.50	33.50	18.37	81.63
	No	15.83	84.17	1.02	98.98

C. Credit Ratings and Ex-Post Performance: Before and After DI

	I		
Constant	-9.252	[7.812]	
DI	-0.146	[0.507]	
Credit Rating_2	0.413 *	[0.247]	
Credit Rating_3	1.594 ***	[0.356]	
Credit Rating_4	1.751 ***	[0.646]	
(Credit Rating_2)*DI	-0.199	[0.410]	
(Credit Rating_3)*DI	-0.170	[0.530]	
(Credit Rating_4)*DI	0.465	[0.762]	
Growth Rate of Real GDP, Inflation Rate, Exchange Rate, Country Risk Indicator	Included	Included	
Number of Observations	158,033	158,033	

TABLE 4: SHARE OF LARGE DEPOSITS

This table reports descriptive statistics for the share of large deposits, using different thresholds for the size of the large accounts.

A. Composition of Deposits by Size

	obs	mean	st. dev.	median	min	max
> US$ 5,000	715	0.92	0.05	0.92	0.82	1.00
> US$ 30,000	715	0.76	0.11	0.74	0.55	0.99
> US$ 50,000	715	0.69	0.13	0.64	0.45	0.98
> US$ 200,000	715	0.44	0.17	0.38	0.16	0.87
> US$ 500,000	715	0.24	0.13	0.19	0.00	0.67
> US$ 1,000,000	715	0.14	0.11	0.11	0.00	0.58

B. Composition of Deposits by Size: Before and After Deposit Insurance

	Before			After		
	mean	st. dev.	median	mean	st. dev.	median
> US$ 5,000	0.93	0.05	0.93	0.92	0.05	0.90
> US$ 30,000	0.77	0.10	0.76	0.75	0.13	0.71
> US$ 50,000	0.70	0.12	0.68	0.67	0.15	0.62
> US$ 200,000	0.45	0.15	0.42	0.42	0.20	0.35
> US$ 500,000	0.26	0.14	0.21	0.20	0.11	0.18
> US$ 1,000,000	0.16	0.12	0.12	0.12	0.10	0.09

TABLE 5: BASELINE MODEL

This table reports probit regressions for the baseline model for *Subprime*_1 and *Subprime*_2. *Subprime*_1 (*Subprime*_2) is a dummy variable that equals 1 if at origination a loan has a credit rating higher than 1 (2). All bank and macro controls are used with a lag of one month. In all cases, the standard errors of the reported coefficients are clustered at the firm level and are reported between brackets. ***, **, and * indicate significance at the 1%, 5%, and 10%, respectively.

	I	II	III	IV
	Subprime _1		*Subprime*_ 2	
Constant	-1.126	-0.609	-2.357	-2.387
	[0.954]	[1.000]	[1.559]	[1.634]
Deposit Insurance dummy	0.314 ***	0.285 ***	0.259 **	0.244 **
	[0.089]	[0.091]	[0.107]	[0.109]
Bolivian GDPgrowth	-0.063 **	-0.062 **	-0.111 ***	-0.108 **
	[0.031]	[0.031]	[0.043]	[0.043]
Bolivian Inflation rate	0.011	0.017	-0.016	-0.003
	[0.017]	[0.017]	[0.025]	[0.023]
Exchange Rate Change	-0.544	-0.520	-1.297 **	-1.322 **
	[0.600]	[0.626]	[0.600]	[0.629]
Market Interest Rate	-0.024 *	-0.024 *	-0.024	-0.020
	[0.014]	[0.014]	[0.029]	[0.026]
Country Risk Indicator	0.015	0.016	0.025	0.026
	[0.014]	[0.014]	[0.022]	[0.022]
Aggregate Nonperf. Loans Ratio	-0.013	-0.057 **	-0.014 *	-0.036 **
	[0.015]	[0.027]	[0.008]	[0.016]
Trend	-0.017 ***	-0.017 ***	-0.004	-0.003
	[0.005]	[0.005]	[0.005]	[0.005]
Herfindahl-Hirschman Index	-1.035	-1.232	-1.235 **	-1.904 ***
	[0.737]	[0.842]	[0.576]	[0.665]
Bank Fixed Effects	NO	YES	NO	YES
Number of Observations	31,543	31,543	31,543	31,508
Pseudo R-square	0.02	0.04	0.01	0.07

TABLE 6: CROSS SECTIONAL IDENTIFICATION

This table reports Probit regressions for the baseline model for *Subprime*_1 and *Subprime*_2. *Subprime*_1 (*Subprime*_2) is a dummy variable that equals 1 if at origination a loan has a credit rating higher than 1 (2). All bank and macro controls are used with a lag of one month. In all cases, the standard errors of the reported coefficients are clustered at the firm level and are reported between brackets. ***, **, and * indicate significance at the 1%, 5%, and 10%, respectively.

	I	II	III	IV	V	VI
	Subprime _1			*Subprime* _2		
	All	DI=0	DI=1	All	DI=0	DI=1
Constant	1.568	7.127 ***	-11.668 **	-2.265	5.027 **	-17.244 ***
	[1.876]	[1.941]	[5.662]	[2.269]	[2.382]	[6.072]
Deposit Insurance dummy	0.224 **			0.324 **		
	[0.097]			[0.159]		
Share of Large Deposits	-1.522 ***	-2.258 ***	0.313	-1.242 ***	-1.773 ***	0.017
	[0.470]	[0.535]	[0.638]	[0.377]	[0.458]	[0.616]
Log(Assets)	-0.444	-1.158 **	0.762	0.039	-0.972 **	0.524
	[0.517]	[0.450]	[1.668]	[0.466]	[0.494]	[1.056]
Log(Assets)_Square	0.032	0.076 **	-0.049	0.004	0.067	0.000
	[0.044]	[0.037]	[0.154]	[0.040]	[0.043]	[0.090]
Capital Ratio	-0.007	-0.041 ***	-0.002	-0.017	-0.060 ***	-0.018
	[0.014]	[0.014]	[0.028]	[0.011]	[0.017]	[0.017]
Nonperforming Loans Ratio	-0.002	-0.035 ***	0.047 ***	0.017	-0.018	0.054 ***
	[0.009]	[0.012]	[0.014]	[0.011]	[0.014]	[0.019]
Loan Loss Reserves Ratio	0.015	0.048 **	-0.041 *	0.005	0.055 **	-0.035
	[0.020]	[0.022]	[0.023]	[0.018]	[0.025]	[0.024]
Profitability	0.016 **	0.009 *	0.015	0.011 *	0.011	-0.001
	[0.007]	[0.005]	[0.014]	[0.007]	[0.008]	[0.008]
Liquidity Ratio	-0.009	-0.028 ***	0.033	0.037 ***	0.004	0.101 ***
	[0.009]	[0.009]	[0.022]	[0.012]	[0.010]	[0.022]
Bolivian GDPgrowth	-0.059	-0.153 ***	0.039	-0.125 **	-0.168 **	0.031
	[0.036]	[0.040]	[0.123]	[0.052]	[0.082]	[0.156]
Bolivian Inflation rate	0.015	0.064 ***	-0.114 ***	0.010	0.043	-0.172 ***
	[0.020]	[0.022]	[0.044]	[0.021]	[0.032]	[0.053]
Exchange Rate Change	-0.408	-2.525 *	-0.916	-1.171 *	-2.292	-1.941 **
	[0.612]	[1.508]	[0.667]	[0.619]	[1.971]	[0.920]
Market Interest Rate	-0.023 *	-0.045 ***	-0.028 *	-0.019	-0.011	-0.044
	[0.013]	[0.017]	[0.017]	[0.022]	[0.019]	[0.031]
Country Risk Indicator	0.013	0.002	0.115 **	0.028	-0.002	0.184 ***
	[0.013]	[0.016]	[0.051]	[0.023]	[0.027]	[0.064]
Trend	-0.018 ***	-0.014 *	0.000	-0.010	-0.001	0.008
	[0.005]	[0.007]	[0.011]	[0.006]	[0.010]	[0.016]
Herfindahl-Hirschman Index	-1.038	-1.413	-0.649	-1.513 **	-2.439 **	-0.987
	[0.779]	[0.975]	[0.655]	[0.596]	[1.147]	[0.675]
Number of Observations	31,302	20,087	11,215	31,202	20,087	11,215
R-squared	0.03	0.04	0.02	0.04	0.04	0.09

TABLE 7: DROP IN THE COST OF DEPOSITS

This table reports Probit regressions for the baseline model for *Subprime*_1 and *Subprime*_2. *Subprime*_1 (*Subprime*_2) is a dummy variable that equals 1 if at origination a loan has a credit rating higher than 1 (2). The *drop of the cost of deposits* is equal to the difference between a bank's average rate on savings deposits in the six months prior to introduction of deposit insurance and the average rate in the subsequent six months. The model is estimated for a sub-sample starting from seven months after the introduction of deposit insurance till the end of the sample. All bank and macro controls are used with a lag of one month. In all cases, the standard errors of the reported coefficients are clustered at the firm level and are reported between brackets. ***, **, and * indicate significance at the 1%, 5%, and 10%, respectively.

	Subprime _1	*Subprime* _2
Constant	11.744 **	2.000
	[5.370]	[8.817]
Drop in the Cost of Funds	0.124 **	0.107 *
	[0.058]	[0.056]
Bolivian GDPgrowth	0.014	0.136
	[0.139]	[0.158]
Bolivian Inflation rate	0.198 **	0.224
	[0.100]	[0.173]
Exchange Rate Change	-4.392 ***	-4.663 ***
	[1.049]	[1.788]
Market Interest Rate	-0.020	-0.003
	[0.024]	[0.031]
Country Risk Indicator	-0.061	0.051
	[0.056]	[0.089]
Aggregate Nonperf. Loans Ratio	-0.056	-0.018
	[0.045]	[0.054]
Trend	-0.140 ***	-0.118 *
	[0.039]	[0.070]
Herfindhal-Hirschmann Index	-1.508 *	-0.730
	[0.839]	[1.067]
Number of Observations	6011	6011
Pseudo R-squared	0.05	0.04

TABLE 8: CONTRACT TERMS

This table reports Probit regressions for Collateral (a dummy variable that equals one if the loan has collateral pledged and equal to zero otherwise) and OLS regressions for Maturity (a continuous variable indicating the number of months between initiation and maturity). All bank and macro controls are used with a lag of one month. In all cases, the standard errors of the reported coefficients are clustered at the firm level and are reported between brackets. ***, **, and * indicate significance at the 1%, 5%, and 10%, respectively

	I	II	III	IV	V	VI
	Collateral			Maturity		
	All	DI=0	DI=1	All	DI=0	DI=1
Constant	0.474	0.941	1.237	42.748 ***	35.106 **	52.682 ***
	[0.834]	[0.898]	[2.447]	[14.246]	[17.725]	[17.811]
Deposit Insurance dummy	-0.420 ***			0.237		
	[0.073]			[1.259]		
Credit Rating_2		0.043	0.371 **		2.917	-1.199
		[0.066]	[0.179]		[2.164]	[0.836]
Credit Rating_3		0.233 **	0.087		4.086 ***	1.520
		[0.098]	[0.178]		[1.538]	[1.560]
Credit Rating_4		0.426 *	-0.064		6.209 *	15.022 *
		[0.258]	[0.680]		[3.375]	[7.923]
Bolivian GDPgrowth	-0.049 *	0.024	-0.145	-0.226	-0.160	-0.962
	[0.026]	[0.028]	[0.113]	[0.438]	[0.386]	[1.173]
Bolivian Inflation rate	-0.052 ***	-0.067 ***	-0.033	0.099	-0.076	0.098
	[0.013]	[0.014]	[0.033]	[0.249]	[0.263]	[0.272]
Exchange Rate Change	0.052	2.533 ***	0.156	-7.178 *	6.142	-1.478
	[0.260]	[0.884]	[0.443]	[4.313]	[18.833]	[3.695]
Market Interest Rate	-0.071 ***	-0.054 ***	-0.065 **	0.003	0.188	-0.265 ***
	[0.014]	[0.016]	[0.030]	[0.151]	[0.319]	[0.087]
Country Risk Indicator	-0.031 ***	-0.049 ***	-0.057	-0.205	-0.156	-0.473 *
	[0.012]	[0.014]	[0.035]	[0.224]	[0.327]	[0.247]
Aggr. Nonperf. Loans Ratio	0.120 ***	0.099 ***	0.137 ***	-1.086 ***	-1.212 ***	-0.705 ***
	[0.017]	[0.017]	[0.027]	[0.091]	[0.105]	[0.116]
Trend	0.013 ***	0.008	0.019 *	-0.099 ***	-0.143 **	0.002
	[0.003]	[0.005]	[0.010]	[0.025]	[0.064]	[0.100]
Herfindahl-Hirschman Index	-0.041	0.249	-0.041	3.132	6.692 ***	-0.890
	[0.283]	[0.484]	[0.433]	[1.918]	[2.408]	[2.309]
Bank Fixed Effects	YES	YES	YES	YES	YES	YES
Number of Observations	31543	21513	10030	31543	21513	10030
(Pseudo) R-square	0.18	0.19	0.26	0.07	0.09	0.08

TABLE 9: ROBUSTNESS CHECKS

This table reports Probit regressions for *Subprime*_1 and *Subprime*_2. *Subprime*_1 (*Subprime*_2) is a dummy variable that equals 1 if at origination a loan has a credit rating higher than 1 (2). These specifications are the equivalent of those reported in Table 6 using two alternative thresholds for the definition of large depositors (i.e., greater than 5,000 US$ or 50,000 US$ as opposed to 30,000 US$, used in Table 6. All bank and macro controls are used with a lag of one month. In all cases, the standard errors of the reported coefficients are clustered at the firm level and are reported between brackets. ***, **, and * indicate significance at the 1%, 5%, and 10%, respectively.

	I	II	III	IV	V	VI	VII	VIII
	Subprime _1				*Subprime* _2			
	DI=0	DI=1	DI=0	DI=1	DI=0	DI=1	DI=0	DI=1
Constant	10.311 ***	-10.768 *	7.048 ***	-11.927 **	8.237 ***	-13.187 **	4.943 **	-11.927 **
	[2.337]	[5.952]	[1.937]	[5.648]	[2.588]	[5.853]	[2.371]	[5.648]
Share of Large Deposits (> US$5,000)	-5.889 ***	-0.467			-5.915 ***	-2.331		
	[1.395]	[1.563]			[1.263]	[1.692]		
Share of Large Deposits (> US$50,000)			-2.090 ***	0.724			-1.473 ***	0.724
			[0.478]	[0.598]			[0.400]	[0.598]
Log(Assets)	-1.009 **	0.806	-1.254 ***	0.685	-0.723	0.206	-1.068 **	0.685
	[0.444]	[1.704]	[0.455]	[1.638]	[0.508]	[0.992]	[0.491]	[1.638]
Log(Assets)_Square	0.064 *	-0.053	0.084 **	-0.043	0.046	0.033	0.075 *	-0.043
	[0.037]	[0.157]	[0.037]	[0.151]	[0.044]	[0.087]	[0.042]	[0.151]
Capital Ratio	-0.035 **	0.006	-0.043 ***	-0.011	-0.046 ***	-0.005	-0.064 ***	-0.011
	[0.014]	[0.028]	[0.015]	[0.028]	[0.016]	[0.015]	[0.018]	[0.028]
Nonperforming Loans Ratio	-0.033 ***	0.049 ***	-0.034 ***	0.047 ***	-0.012	0.060 ***	-0.018	0.047 ***
	[0.012]	[0.014]	[0.012]	[0.015]	[0.014]	[0.021]	[0.014]	[0.015]
Loan Loss Reserves Ratio	0.030	-0.043 *	0.053 **	-0.043 *	0.032	-0.047*	0.060 **	-0.043 *
	[0.022]	[0.023]	[0.023]	[0.024]	[0.026]	[0.026]	[0.025]	[0.024]
Profitability	0.009 *	0.015	0.010 **	0.014	0.010	-0.002	0.011	0.014
	[0.005]	[0.014]	[0.005]	[0.013]	[0.008]	[0.008]	[0.008]	[0.013]
Liquidity Ratio	-0.032 ***	0.028	-0.026 ***	0.036 *	-0.004	0.094 ***	0.006	0.036 *
	[0.009]	[0.021]	[0.009]	[0.022]	[0.010]	[0.021]	[0.010]	[0.022]
Bolivian GDPgrowth	-0.146 ***	0.035	-0.150 ***	0.042	-0.163 **	0.029	-0.165 **	0.042
	[0.039]	[0.122]	[0.040]	[0.124]	[0.081]	[0.154]	[0.082]	[0.124]
Bolivian Inflation rate	0.061 ***	-0.107 **	0.064 ***	-0.119 ***	0.042	-0.155 ***	0.043	-0.119 ***
	[0.021]	[0.043]	[0.022]	[0.044]	[0.032]	[0.050]	[0.032]	[0.044]
Exchange Rate Change	-2.628 *	-0.948	-2.431	-0.867	-2.382	-2.015 **	-2.220	-0.867
	[1.526]	[0.670]	[1.505]	[0.660]	[1.982]	[0.931]	[1.975]	[0.660]
Market Interest Rate	-0.044 ***	-0.028 *	-0.045 ***	-0.029 *	-0.012	-0.044	-0.011	-0.029 *
	[0.017]	[0.016]	[0.017]	[0.017]	[0.019]	[0.030]	[0.019]	[0.017]
Country Risk Indicator	0.004	0.109 **	0.003	0.118 **	0.000	0.167 ***	-0.002	0.118 **
	[0.016]	[0.050]	[0.016]	[0.051]	[0.028]	[0.062]	[0.027]	[0.051]
Trend	-0.012 *	-0.002	-0.015 **	0.002	0.001	0.005	-0.001	0.002
	[0.007]	[0.011]	[0.007]	[0.011]	[0.010]	[0.016]	[0.010]	[0.011]
Herfindahl-Hirschman Index	-1.418	-0.632	-1.388	-0.679	-2.462 **	-1.003	-2.412 **	-0.679
	[0.967]	[0.661]	[0.973]	[0.653]	[1.139]	[0.675]	[1.150]	[0.653]
Number of Observations	20,087	11,215	20,087	11,215	20,087	11,215	20,087	11,215
Pseudo R-square	0.04	0.02	0.04	0.03	0.04	0.09	0.04	0.03