Do Property Titles Increase Credit Access Among the Urban Poor? Evidence from a Nationwide Titling Program[†]

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Abstract

A fundamental link in the theory of property rights and economic development is the assumption that the collateral value of landholdings increases with ownership rights, thereby improving credit access among landholders. However, in impoverished settings, it is ambiguous whether strong property institutions can reduce credit rationing given other barriers to lending. A nation-wide urban land titling program in Peru, the largest formalization program targeted to urban squatters in the developing world, provides a dramatic natural experiment for testing whether strengthening property institutions enables lenders to profitably use low-income housing as collateral. This paper conducts an evaluation of early program impact on credit supply using variation in the timing of the program to estimate the average treatment effect of receiving a title on loan approval rates of public and private sector lenders. Detailed data on the information used by banks to screen loan applicants allows us to observe directly the role of property titles in approval decisions, thus enabling us to isolate the effect of titles on supply from their effect on demand. Our estimates indicate that urban land titling is associated with a 9-10 percentage point increase in loan approval rates from the public sector bank for housing construction materials, while there appears to be no effect on the loan approval rate of private sector lenders. However, conditional on receiving a loan, private sector interest rates are an average of 9 percentage points lower, indicating a limited improvement in credit rationing and financial market inequalities for the urban poor.

Keywords: Credit rationing, property rights, collateral, risk premium

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1 Introduction

A large body of work has documented extensive credit rationing in developing countries in which low-income households are excluded from the formal banking sector.[1] A critical barrier to access is the frequent inability of small and informal borrowers to securitize loans with collateral, often a necessary condition for participation in formal credit markets.[2] One frequently cited contributing factor is the fact that in much of the developing world a large percentage of both rural and urban property is untitled (Holden, 1997). Although land is an advantageous form of collateral due to the fact that it cannot be removed and does not easily devalue, it is widely believed that many borrowers face barriers securing transactions with land simply because ownership rights are not formally documented.[3]

Consistent with this notion, government land titling programs are widely considered a critical instrument for increasing access to credit among the poor, and wide scale land-titling has become a popular policy prescription for alleviating credit rationing in developing countries (Binswanger, et al., 1999).[4] However, despite the widespread use of land collateral in loan transactions in developed countries, the ability of property titles to transform modest landholdings into a viable form of collateral for commercial loans can not be taken for granted. In particular, the use of property titles to securitize loans may fail in many impoverished settings where transaction costs associated with collateral processing, foreclosure and resale are large relative to the average size of loan requests.[5] Such costs are particularly high when political or legal factors impede repossession of property as is the case in many developing countries.[6] Even when foreclosure is feasible, there is often a high degree of mistrust among lenders as to the

[1] Here, credit rationing refers to non-price rationing, in which asymmetric information and enforcement costs prevent price from serving as the market-clearing mechanism, producing a disequilibirum situation of excess demand in the credit market (Stiglitz and Weitz, 1981). For an overview of this literature, see Hillier and Ibrahimo (1993) and Jaffee and Stiglitz (1990).

[2] According to Berger and Udell (1990), in the US, around 70% of all commercial and industrial loans are secured with collateral. Meanwhile, "Lack of collateral satisfactory to banks has almost always been a constraint on disbursement of World Bank SME lines of credit" (Balkenhol et al., 1995).

[3] Furthermore, in many countries including Peru, legal barriers restrict the use of movable property as collateral, such that real estate is the only viable form of security interest (Fleisig and de la Pena, 1996).

[4] Feder and Feeney (1991) claim that "the most commonly recognized benefit from legal titling of land is the use of those secure ownership rights as collateral to solicit credit."

[5] Formal procedures often entail high transactions costs, such that collateral secured with informal practices may prevail even when formal liens on property can be achieved (Feder and Feeny, 1991).

[6] Data suggest that political impediments to foreclosure on smallholders land are often quite significant (Deninger, et al., 1993).

validity of ownership documents, and the cost of verification may remain prohibitively high even in the context of a formal property system. If poor households are "transaction-cost rationed" in formal credit markets, the lower default risk brought about by the provision of titled property as collateral may be insufficient to facilitate access to loans. Indeed, past research has found the impact of rural titling programs on both credit supply and investment demand to be strongly size-differentiated, such that small producers remain rationed out of the credit market even with a title.[7]

Hence, in an era of urban land titling reform motivated by credit market improvements, a key question is whether distributing property titles to squatter households does in fact enable lenders to profitably use low-income housing as collateral. While there is some evidence of changes in the supply of credit associated with rural titling programs, all of the existing empirical work on property titles and credit supply has focused on agricultural markets.[8] Meanwhile, not only is there a growing need to evaluate the impact of urban land reforms, but titling programs arguably have larger potential impact on the supply of credit in urban settings where geographic barriers play a minimal role in the transactions costs of formal lenders.[9] In this paper, we address this question by analyzing lenders' responses to changes in formal ownership rights that resulted from a nation-wide titling effort in Peru in which property titles were distributed to more than 1.2 million urban households. In addition to focusing on rural financial markets, the majority of past work has focused on changes in the demand for credit or changes in the total amount of borrowing associated with improvements in ownership rights, here we look at the isolated role of collateral provision in the determination of debt contracts for households in the program target population. Staggered program timing and cross-section micro-data collected midway through the program enables a comparison of households in neighborhoods already reached by the

[7] See Carter and Olinto (1997).

[8] Empirical evidence of a credit supply effect of land titling comes from a study by Feder et al. (1988) of rural credit markets in Thailand. In three of the four provinces covered, households' credit supply had been significantly enhanced by the availability of title. In addition, both farmers' opinions and econometric evidence indicated that improved credit supply was the main benefit from titling. Similar findings are reported using panel data from Brazil (Alston et al. 1996), Honduras (Lopez 1997) and Paraguay (Carter and Olinto 1997). In line with the above, title was found to have little impact on farm investment or farm income where no formal credit markets were available (Atwood 1990, Carter and Wiebe, 1990; Migot Adholla et al. 1994). However, Christensen et al. (1993) provide evidence of titles facilitating access to informal credit markets as well.

[9] Correspondingly, in Peru and many other countries, titled urban households have a higher incidence of formal borrowing than do titled rural households.

program with households in neighborhoods not yet reached. In this manner, we assess the effect of obtaining a property title on the likelihood of receiving a bank loan conditional on applying, and the terms of loan contracts provided.

Our exploitation of this natural experiment to overcome endogeneity concerns is a central contribution of the paper. Two principal endogeneity issues arise in measuring the collateral value of property titles by comparing titled to untitled households. First, strong property institutions may be spuriously correlated with well-functioning credit markets, such that ownership rights and credit access have an observed correlation but no causal relationship. Furthermore, the decision to title property may be a function of property values or the perceived collateral value of titled land.[10] For instance, households may have a tendency to seek property titles in communities where loan transactions are less costly for other reasons.[11] If tenure status is endogenous to land values or financial markets, the collateral value of titled properties will overstate the gains to titling untitled properties. The Peruvian program, in which all households were "assigned" property titles irrespective of household demand for formalization, helps isolate the causal effect of property titling on credit market outcomes by reducing the endogeneity concerns associated with tenure status.

The second complication in measuring the program effect on credit supply arises from the fact that land titling efforts have the potential to affect both demand for and supply of credit. In particular, demand for credit is also a function of ownership rights given that tenure security influences individuals' incentives to undertake land-related investments.[12] In the proceeding analysis, we attempt to isolate the effect of property titles on credit supply from their effect on demand by making use of extensive micro data on individual bank requirements for processing both approved and unapproved solicitations for credit. With data on all information and documents the household was asked to provide when applying for a loan, we can reconstruct with relative precision the information set on which banks' loan approval decisions were based. In this manner, we control for compositional changes in characteristics of the household relevant to credit-worthiness resulting from changes in the pool of credit applicants, legitimizing a

[10] Direct evidence of this is provided by Miceli et. al. (2001), who analyze the extent of endogeneity of formal agricultural property rights in Kenya.
[11] For instance, households may be more likely to title land in communities in which a relatively well-functioning local property registry makes title verification less costly for banks or a local court is known to uphold loan contracts in favor of repossession.
[12] See Besley (1995) for a formal presentation of this argument.

selection on observables model to identify the causal effect of titles on credit supply independent of demand.

Even more importantly, within the set of reported screening criteria we are able to observe whether a household was asked to provide a property title with their loan application. Clearly, improved access to credit resulting from changes in the collateral value of land can only occur within the set of banks that ask for proof of ownership status. Meanwhile, any difference in the amount of credit supplied to titled households that is driven purely by demand-side factors would be independent of banks' use of property titles to screen loans, conditional on the amount of credit requested. Hence, by testing whether credit supply changes only among banks requesting titles we can isolate changes in supply from the program effect on demand.

Our estimates indicate a limited reduction in overall credit rationing and financial market inequalities for the urban poor associated with titling programs. In particular, households with no legal claim to property are 9-10 percentage points less likely to secure a loan from the public sector bank for housing construction materials. Among this subsample of loan applicants, the effect is concentrated entirely among those that were asked to provide a title as collateral, providing evidence that the observed program effect is indeed a result of the increase in the collateral value of property and not driven by unobservable differences in the overall creditworthiness of titled and untitled applicants. Meanwhile, we find no effect of formal property ownership on approval rates of private sector lenders. However, conditional on receiving a loan, titled households face private sector interest rates an average of 9 percentage points lower. Since the measured effect is independent of banks' reported use of titles in loan transactions, the program effect of titling on private sector interest rates appears to operate through the signaling value of property titles and not by way of increasing the fraction of debt securitized with collateral. However, it is impossible to distinguish the signaling model from differences in credit-worthiness observable to banks but not captured by the survey data on reported lending criteria.

2 Theoretical Issues

Loan contracts are not only characterized by their interest rate, but also, as emphasized by Baltensperger (1976), by non-price elements including collateral requirements.[13] Poor borrowers are frequently denied access to loans because they lack adequate collateral to offer the lender as a warranty for their loan and also because of high costs of monitoring and processing relative to the magnitude of loans requested (Hoff and Stiglitz, 1990).

Formal treatment of the link between property rights and credit supply is provided by Besley (1995) and Feder (1985). The principal argument is that formal property titles encourage lenders to use land as collateral by lowering the risk of collateral loss, the information costs involved in verifying ownership and the foreclosure costs under default, thereby reducing the effective leverage ratio and increasing the net collateral value of land. As discussed by Besley, in competitive markets with full information, improved access to collateral reduces the risk premium on lending and hence the interest rate borrowers face. Meanwhile, in the presence of information asymmetries, the use of collateral can eliminate credit rationing by reducing agency problems.

To motivate the empirical question, we consider the model of Bester (1985), in which collateral is used in conjunction with the interest rate to achieve separation of risk types and eliminate credit rationing. Here, a banker faces a heterogeneous distribution of potential borrowers represented by an unobservable risk parameter, θ, such that $\theta \in \{\theta_a, \theta_b\}$, where θ_b is a higher risk type than θ_a. The fact that the banker is unable to identify types will lead the banker to screen borrowers by offering a menu of contracts $\gamma_i = (R_i, C_i)_{i \in I}$ specified with interest rate R_i, and collateral requirement C_i, and constructed in such a way that each type of borrower will choose a specific type of contract.[14] A priori two types of Nash equilibria can be obtained: a separating equilibrium, in which different borrowers choose different contracts, and a pooling equilibrium in which both types of households choose the same contracts.

In this paper, we test whether a land titling program in which households change from owning no collateral to owning collateral induces a separating equilibrium.[15] In the absence of

[13] The theoretical function of collateral in lending is discussed extensively by Binswanger et al. (1985), Barro (1976), Benjamin (1978), and Plaut (1985).
[14] As discussed by Bester, the result depends on the correlation of borrowers' preferences and risk type.
[15] See Bester (1985) for the formal proof of this equilibrium.

collateral, quantity rationing will occur if adverse selection inhibits lenders from raising the equilibrium interest rate. However, as shown in Bester's model, if the equilibrium exists, no credit rationing will occur post-reform because the acquisition of property titles enables banks to effectively use contracts with different collateral requirements as a screening mechanism to separate low-risk from high-risk borrowers.[16] Hence, for beneficiaries of the titling program, the process of going from an equilibrium with only one set of price characteristics to another in which contracts contain non-price components may prevent or reduce credit rationing. Clearly, this result depends fundamentally on the degree to which titling land encourages lenders to use property as collateral. Perfect sorting without rationing may be unattainable if titled borrowers still face a binding constraint on the amount of collateral they can provide.[17]

In addition, land titles may have value in loan transactions other than their use as collateral for securitizing debt. First, property owners may be offered more credit even when no collateral is provided on account of titled households' higher expected wealth from reduced expropriation risk. If lenders use wealth as a signal of default risk, titling may give rise to an alternative separating equilibrium in which *all* titled borrowers are considered less risky irrespective of type, lowering the collateral and interest rate requirements on all equilibrium contracts even when loans are not collateralised with property.[18]

Secondly, land titles may influence other borrower characteristics that determine credit-worthiness, most notably employment. In particular, if ownership rights increase household labor hours as found in Field (2002), the corresponding increase in wage income could improve applicants' access to credit. In this paper we ignore the indirect influence of ownership rights on credit-worthiness via changes in employment patterns in order to concentrate on the direct effect of titling on banks' use of property as collateral. Hence, the results provide a lower bound estimate of the total program effect on credit access.

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[16] We are for simplicity ignoring the possibility of equilibrium credit rationing, in which a borrower's demand for credit can be turned down even if the borrower is willing to pay the entire price and non-price elements of the loan contract. For a discussion, see Baltensperger (1978).

[17] For example, if it is prohibitively costly for banks to assess the value of property titles or if the value of property does not exceed the transactions costs involved in processing loans.

[18] Barham et al. (1996) note that lenders may use wealth to assess borrowers' risk level since "repayment capacity under a negative income shock is likely to be lower for [poor] borrowers because of their inability to suppress consumption to meet loan repayments and … inability to establish a diversified asset portfolio."

3 Empirical Methods

This research examines the Peruvian government's recent series of legal, administrative and regulatory reforms aimed at promoting a formal property market in urban squatter settlements. In 1996, under the auspices of the public agency, COFOPRI (Committee for the Formalization of Private Property), and *Decree 424: Law for the Formalization of Informal Properties*, the Peruvian government embarked on an innovative nationwide property titling program, whose goal was "the rapid conversion of informal property into securely delineated land holdings by the issuing and registering of property titles" (World Bank, 1998b).

Implementation involved area-wide titling, in which project teams entered one neighborhood at a time, moving contiguously within cities until all informal settlements had been reached (World Bank, 1998c). While the old process of acquiring a property title was prohibitively slow and expensive, the new process was virtually free and extremely rapid.[19] In order to be eligible for program participation, title claimants were required to verify residency predating 1995, and had to reside on eligible public properties.[20] As a result of the reforms, roughly 80% of the country's previously untitled residents eligible for program participation became nationally registered property owners, affecting approximately 6.3 million individuals living in the range from just above to below the poverty line.[21] Correspondingly, the value of residences that were titled through the program was relatively low: in a random sample of titled and untitled households in Lima, the average property size of untitled lots was roughly 60% the average size of titled lots prior to the intervention.[22]

3.1 Data

To study the effect of receiving a property title on credit access we use survey data containing 2750 households randomly sampled from the program target population in March 2000. The survey instrument was modeled after the World Bank *Living Standards Measurement Surveys (LSMS)*. In addition to detailed information collected on household and individual

[19] See Field (2002) for an overview of the titling process.
[20] Informal title documents from local registries, post-dated mail and utilities bills, and signed sales documents were used to provide proof of residency.
[21] By December 2002, 1.64 million lots had been formalized and 1.21 million titles granted, the vast majority of which took place between 1998 and 2000.
[22] Source: *COFOPRI Baseline Survey*, March 2000.

characteristics, this survey is remarkable for collecting an extensive array of self-reported data on all loan applications requested by the household between 1997 and 1999 including bank requirements and the terms of loans provided.

In order to tackle the question of whether improvements in land rights reduce credit rationing, our empirical analysis employs a quasi-experimental setup that ideally mimics an experimental design with treatment and control groups. Because the survey was conducted approximately one-third of the way through program implementation, roughly 60% of surveyed households reside in neighborhoods in which the program has not yet entered. Hence, the treatment group is composed of 536 households that have already participated in the titling program and the control group comprises those that have not.[23] The control group is further refined to include only the 1180 households that are eventual participants in the sense that they do not already posses a registered property title at the time of the survey.[24]

Table 1 provides descriptive statistics on the sample population, allowing an informal check for random assignment of program timing. As the means in the table indicate, there is very little variation in demographic characteristics across program and non-program regions. In contrast, titled and untitled households exhibit substantially different patterns of borrowing and housing investment behavior, logically a reflection of greater demand for investment in immobile assets associated with higher tenure security. In particular, titled households are 10% more likely to have undertaken housing improvements in the two years prior to the survey and 8% more likely to have ever made improvements to the house.[25] Of those that engaged in housing improvements between 1997 and 1999, treatment group households are 15% more likely to finance improvements with a formal loan, and the difference is statistically significant.[26]

Correspondingly, there is also a significant increase in formal credit demand, as measured both by the fraction of titled households that apply for formal sector loans and the fraction that

[23] In the results presented in the paper, as opposed to an intent-to-treat (ITT) analysis, households in titled neighborhoods that have not yet received a title are excluded, presenting a potential bias in the comparison of experimental groups if ability to secure a title is related to overall credit-worthiness. However, ITT estimates reveal that the magnitude and significance of results are robust to an ITT model.
[24] As a result, 1034 households that had acquired registered land titles under normal procedures prior to the program were disregarded.
[25] This difference persists almost entirely in regression-controlled means accounting for years of residential tenure, indicating that the difference is not simply a result of treatment group members living in newer neighborhoods and thus being more likely engaged in housing improvements in recent years.
[26] Information comes from the survey module on lending activity as well as survey questions from the home investment module which asks how construction was financed.

report willingness to accept a loan from a formal lender, which are respectively 18 and 14 percentage points higher for titled households. Regression estimates of the effect of property titles on formal credit applications that control for observable household characteristics are reported in Appendix 1. These estimates indicate that household traits account for more than half of the difference in loan application rates between titled and untitled households.

Columns 3 and 4 of Table 1 compare observable characteristics of titled and untitled loan applicants, the subpopulation used in our analysis. Despite observed differences in the demand for credit associated with property ownership, among the pool of credit applicants in columns 3 and 4 of Table 1, observable differences between untitled and titled households are even smaller with respect to almost every demographic characteristic. This indicates that the subpopulation of marginal applicants, or those that are encouraged to apply for a loan in response to receiving a titling, are similar in observable characteristics to the subpopulation of unconditional applicants.

3.2 Aggregate Level of Credit Rationing

Before attempting to tease apart the supply-side from demand-side effects, we first explore whether changes in the demand for loans are accompanied by changes in the aggregate level of credit rationing. If the net change in the level of borrowing exceeds the increase in demand for loans that accompanied the titling program, we can conclude that credit access has also improved post-reform. Following the definitions of Feder et al. (1990), we classify all households in the sample as fully constrained, partially constrained, or unconstrained (price rationed) in formal credit markets. Households that were rejected in all loans for which they applied are classified as fully constrained. Meanwhile, borrowing households are classified as partially constrained if they applied for a larger amount of credit than was granted and unconstrained if all loans were approved.

As opposed to inferring demand only from observed loan requests, we follow Boucher et al. (1999) and use survey information on the credit market experiences of households to construct a measure of latent demand among non-borrowing households. In particular, in the survey questionnaire households that do not request loans are asked if they would have accepted credit from a given source. Households that do not apply for any formal loans but report that they

would accept credit from at least one of these sources are assumed to have self-sorted out of the credit market, and are classified as fully quantity rationed. Those that report that they would not accept credit from any formal source are divided into two categories based on their reasons for not applying. Those that state fear of losing collateral as the reason for not applying are classified as fully "risk-rationed." If they would not accept credit for any reason other than fear of losing collateral, they are assumed to have zero demand and hence are price rationed at the available interest rate.

Interestingly, the pattern of credit rationing in Table 2 indicates that an identical fraction (34%) of titled and untitled households are fully rationed out of the credit market in the sense that they either apply for credit and are rejected or do not apply but would accept a loan. Meanwhile, the numbers suggest clear differences in the pattern of credit demand between titled and untitled households. In particular, the fraction of households that either applies for or would accept a loan rises from 60 to 73 percent, while the fraction that actually applies rises from 40 to 47 percent. All of the increase in applicants is absorbed by the increased fraction of households that are partially rationed. Since the increased fraction of households that borrow approximately equals the increased fraction that applies, we cannot automatically infer from these patterns that the rise in demand for credit was accompanied by a change in supply. Instead, it is possible that the increased fraction of loan applicants comes entirely from the population who were previously credit-worthy but unwilling to borrow. In other words, either there is perfect self-sorting among new credit market entrants, or there are corresponding improvements in the availability of credit to households with property titles.

Another interesting observation from Table 2 is the fact that a significantly smaller fraction of titled households are risk-rationed in the credit market, whereas tenure security is generally thought to give rise to an increased level of risk-rationing. In contrast, this pattern suggests that perceived risk associated with collateral use is *negatively* related to ownership rights among urban households, which would be the case, for instance, if banks had greater repossession rights over property documents that were not fully registered. Changes in property institutions that are accompanied by increased protection of homeowners from collateral loss should generally reduce banks' willingness to securitize loans with property.

3.3 Household Borrowing Behavior

Table 3 presents categories of formal credit available to households in the sample and the fraction of loan applications to each source. The columns on the right-hand side compare credit sources of titled and untitled households. Here we observe three main categories of banks participating in formal credit markets in urban Peru, including both private and public-sector lenders. According to the survey, the most important source of credit – making up 35% of all loan applications and 45% of all formal loan applications – is from the public sector Materials Bank. The Materials Bank (henceforth MB) has historically been one of the largest lending institutions in Peru.[27] Since 1980, MB has targeted in-kind loans of housing construction materials to the urban population living in human settlements, housing cooperatives and popular housing associations, exactly the target population of the urban titling program.[28] The maximum loan amount is roughly $5000, loans are relatively long-term (up to 15 years), and the bank's official guidelines for lending maintain effective annual interests rates between 7% and 9% on all loans.[29] Households in this sector are highly dependent on MB for construction materials. Among all households that financed improvements with credit obtained between 1997 and 1999, 73.3% of loans were from MB.

Among other creditors, loan applications are fairly evenly divided between supplier or store credit ("hire purchase" credit), credit from other private sector lenders and informal credit.[30] In-kind loans from retailers or wholesale suppliers (henceforth "supplier credit"), which take the

[27] The volume of MB loans peaked around 1990, and has fallen ever since, although MB still accounts for the majority of credit in the target population of households.

[28] These two government programs, however, operate independently, such that there is no explicit relationship between neighborhoods targeted for program intervention and MB operations (personal interview with Daniel Andaluz, August 14, 2002, COFOPRI office, Lima, Peru).

[29] While MB functions somewhat as a government relief plan, loan approval is not automatic. To qualify for a loan, the bank's guidelines stipulate that the borrower have a minimum monthly family income equivalent to five times the estimated monthly payment, and borrowers may be asked to provide a co-signer. The bank guidelines also state that all loans will involve a lien on the house as collateral for the loan, although a registered mortgage on land is not required. In this sense, in theory all MB loans involve full inside collateralization, such that in the case of default, control of the construction project and ownership of depreciated assets shift to the lender. In cases in which land mortgages backed by a registered property title are used in place of lien mortgages, the loan is additionally securitized with outside collateral. See Chan and Kanatas (1985) for a discussion of these concepts. Official guidelines are reported on the bank's website: www.banmat.org.pe. As Banerjee and Duflo (2002) point out, it is an open question as to how closely banks follow these guidelines.

[30] Because of the importance of utilizing data on bank loan requirements, our formal analysis excludes the informal credit market, where unobservable factors are much more likely to determine credit access.

form of inputs or merchandise advanced as credit, constitute a full 21% of loan applications from households in the sample. Supplier credit is available through stores specializing in selling consumer electronics and home appliances directly to clients on a credit basis and is generally offered interest free or at very low interest rates, but for short periods of time (Dunn, 1999). In addition, the prices of goods supplied on credit are often considerably higher than the prices that can be found through cash purchases in wholesale markets or from retailers. Thus, the implicit real interest rates are likely to be fairly high.[31] However, because of the nature of interest rates on supplier credit, *reported* interest rates are extremely low and often zero. Furthermore, supplier loans have a nearly 100% approval rate, likely due to the fact that repossession allows the good being supplied to serve as collateral against the debt (i.e. full inside collateralization). As a result, property titles are rarely used as collateral to obtain supplier credit, so there is little possible impact of land titling on the supply of inputs or merchandise advanced as credit.[32]

Other private sector financial institutions include commercial banks and savings and loan organizations – including commercial micro finance lenders such as MiBanco –, credit cooperatives, EDPYMEs, village banks, and NGOs. All of these financial institutions except village banks and NGOs are regulated by the national bank superintendency.[33] Since there are very few applications to semi-regulated or unregulated lenders in our data, in our empirical analysis all of these private sector credit institutions are grouped together and estimates are run on the pooled sample along with a dummy indicator of the type of institution. While sample size prevents us from studying separately the impact of a title on non-regulated lenders, the results from the pooled sample are robust to excluding village banks and NGOs.

Meanwhile, since the lending practices of MB and supplier credit are much different from those of private sector financial institutions, we separate formal loan transactions into these three categories throughout the analysis. Most importantly, the nature of credit rationing is likely to be distinct in the market for MB loans for two reasons. First, because MB is designed to reach low- to middle-income households, local branches are positioned and bank administrators are accustomed to operating in these neighborhoods. Therefore, low income households are less

[31] For instance, a study by Barham et al. (1996) in Guatemala found that store credit was commonly provided at a 7% premium.
[32] In the survey data, property titles were used in only six loan applications.
[33] In Peru, the interest rate on regulated private sector loans is unconstrained by the government. EDPYMEs represent an intermediate stage between unregulated credit organizations and regulated banks. See Nexus (1998) for a description of the rules for EDPYMEs.

likely to be transactions-cost rationed for MB loans. Secondly, because MB loans are for housing construction, loan amounts are on average larger and have a lower variance than loans from other institutions. The lending practices of MB are also distinct in that they potentially entail substantial project monitoring. Not only are construction materials purchased by the bank itself, but prospective borrowers must present a certified building plan when applying and construction projects are at least minimally overseen by bank field representatives.

Table 3 also reveals significant differences in loan application behavior between titled and untitled households. In particular, titled households are much more likely to request both public and private sector loans. Meanwhile, the fraction of loans sought from stores and informal sources does not vary by ownership status. Table 4 sheds light on the nature of differences between credit applicants to each type of lender. On average, MB loan applicants have lower socio-economic status, evidenced by the fact that they have lower education levels, a greater fraction of female-headed households, lower wage income, higher education expenditures per year, a higher fraction of extreme poor, and lower income from entrepreneurial activities. It is worth noting that, in spite of having virtually equivalent monthly wage income, applicants to regular banks have higher monthly spending in all categories of consumption, likely due to the fact that they are spending less of their earned income on housing investment. In addition, the last three rows in Table 4 reveal that mean loan approval and interest rates are distinct across types of lenders.

Because the sample sizes are small, there are very few significant differences between titled and untitled households *within* each category of loan. One notable difference is that, among applicants for private sector loans untitled households are relatively more educated, while in the pool of MB applications untitled applicants are less educated. For all education categories, these differences in differences are statistically significant. With respect to loan application outcomes, the mean differences in approval and interest rates indicate that a higher fraction of titled applicants receive MB loans, and that titled applicants face lower average interest rates on private sector loans.

3.4 Econometric Model

We attempt to measure the collateral value of land titles by modeling the outcomes of individual credit applications. Inference about the impact of titling on an individual loan

applicant's rate of approval involves speculation about how what the applicant would have experienced in the absence of a title. The simplest of such models is:

$$y_{ij} = \alpha_i + \gamma d_j + \varepsilon_i$$

where *j* is the index for the control group (j=0) and the treatment group (j=1) and d_j is 1 if the household has a title and zero otherwise, and γ is the treatment effect of property titling. In this sense the no-treatment counterfactual is assumed to obey an additive model, while the treatment effect is constant:

$$y_{i0} = \alpha_i + \varepsilon_i \quad (1)$$

where $y_{i1} - y_{i0} = \gamma$ and $E[y_{i0}] = \alpha_i$. Equation (1), which states that the only reason access to credit changes in the treatment group is because of titling, is required for identification. To estimate the hypothetical difference in credit access for households that received COFOPRI titles compared to the same household without a title we follow the Roy-Rubin model.[34] If we define a binary assignment indicator, *D*, indicating whether a household participated in the program, the treatment effect on each household is then defined as the difference between its potential outcomes:

$$\Delta = Y^T - Y^C$$

where Y is the change in the probability of access to credit. Since there is no opportunity to ever estimate individual gains with confidence without observing Y^T and Y^C for the same individual simultaneously, we have to concentrate on the population average gains from treatment, or the average treatment effect on the treated:

$$E[\Delta| D=1] = E(Y^T | D=1) – E(Y^C | D=0)$$

Then, if the condition $E(Y^T| D=1)=E(Y^C | D=1)$ holds we can use non-participants as an adequate control group. If, in addition to the treatment and outcome, we also observe a background variable (or vector of variables) X_i, and we believe that the treatment depends on the potential outcomes only through X_i, we can state the unconfoundedness condition formally as:

$$E(Y^T | D=1, X_i =x) = E(Y^C | D=1, X_i =x)$$

As mentioned previously, in non-experimental data, having a land title would generally *not* be independent of potential outcomes since both the decision to obtain a title and the decision

[34] The original ideas can be found in Roy (1951) and Rosenbaum and Rubin (1994). For further discussion of these approaches, see Hujer and Wellner (2000) and Lechner (2000).

to apply for a loan are likely to be correlated with the local lending environment or with unobserved characteristics of the property related to its value. The fact that property titles were assigned in our data in a quasi-experimental fashion independent of household demand for tenure security or credit reduces concern over the endogeneity of tenure status. Furthermore, the absence of observable differences in applicant types according to program participation in Table 1 lends confidence to our ability to identify treatment effects using untitled applicants as a control group. Nonetheless, the large apparent changes in investment demand raise concern over heterogeneity in the pool of loan applicants.

To distinguish whether mean differences between the treatment and control groups reflect changes in the collateral value of land as opposed to changes in the pool of applicants arising from increased demand for credit we make use of detailed survey data on the information used by banks in the screening process. In our data, all households that applied for a loan were asked to report the complete set of documents and information including property titles required by the bank to process the loan, regardless of whether or not the loan was approved. From the list of requirements, we can identify relevant a wide array of characteristics of a given household used by banks in the loan decision. Since loan approval decisions are made by formal lenders on the basis of a finite set of observable characteristics of the applicant, X_i, loan approval outcomes depend only on X_i and treatment (having a land title). Hence, if the set of household characteristics reported by the household and included as control variables in the regression reasonably captures the information set on which the lenders base their approval decisions, the average treatment effect of a property title will be identified. In other words, while differences in the demand for credit are likely to generate differences between treatment and control applicants, given sufficient information on both X_i and the bank's approval algorithm, unconfoundedness is likely to hold conditional on all characteristics of the household observed by banks at the application stage in a selection on observables model. Furthermore, even if differences in credit-worthiness remain that are observable to banks but not captured by the data on loan requirements, these differences should be absorbed by the difference in approval rates between titled and untitled households among the approximately half of lenders that do not request a title.

We first estimate the loan approval decision with the following probit model: [35]

[35] For households with multiple applications to a given type of bank we use only the most recent application and control for the whether or not the household applied for other formal loans from each

$$Pr(approval)_i = \beta_0 + \beta_1(title) + \beta_2(title*title\ used\ in\ screening) + \alpha' X_i + e_i \quad (2)$$

Here, X_i contains the set of household characteristics relevant to each applicant based on the reported requirements of the bank. The coefficient estimates on both the dummy indicator of whether a household acquired a property title through the program, β_1, and this interacted with an indicator of whether or not the applicant was asked to provide a title in the loan transaction, β_2, provide inference on the existence and magnitude of a treatment effect of titling. If loan approval rates are higher among the treatment group because property titles are used as collateral, the treatment effect will be fully concentrated among loans in which a title was used in the screening process. Hence, if the treatment effect is absorbed by β_2 we can rule out the possibility that differences in application outcomes are driven by unobservable differences across treatment and control applicants. Conversely, if differences in loan approval rates across experimental groups are driven by more credit-worthy households entering the pool of titled applicants, approval would be independent of the screening process.

Table 5 presents all loan requirements of banks reported in the data.[36] Personal identity documents, property titles, wage receipts, co-signer, reported self-worth and utilities receipts are the most common loan application requirements. In total, 51% of loan applicants comprising a roughly equal proportion of titled and untitled applicants are asked to provide a property title prior to the loan approval decision. In less than ten percent of applications, banks require other documentation of repayment capacity, including lending group membership, rental contracts, tax receipts, tax numbers ("RUC"), and business registration or professional license documents. Only a handful of banks ask for bonds or collateral in the form of household goods.

To account for these requirements, our empirical estimates control for a number of relevant household characteristics available from the survey. It is important to note that, while several of these variables are potentially endogenous to program participation, in order to isolate the direct effect of titling on banks' use of collateral it is necessary to account for simultaneous changes in other household characteristics relevant to loan approval decisions. In this sense, here

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category of bank between 1997 and 1999. Robust standard errors are used throughout to account for survey clusters and strata.

[36] A potentially important source of missing data is the category of loan requirements labeled "other", in which the exact requirement was not specified by the household. To correct for this missing information, we include a larger set of potentially relevant household characteristics that might fall under this category.

we do not measure the net effect of land titling on credit access which includes indirect channels such as employment. To capture wage income, we control for: total monthly household wage income, monthly earnings of the highest wage earner, whether highest wage earner is self-employed, whether worker with greatest number of hours is self-employed, monthly earnings of the highest contracted employee, and fraction of household wages from contracted employment. We separate self-employment and contract from non-contract employment given that commercial banks may only accept formal wage receipts, although households are likely to report all wage income. To capture the reported self-worth of the loan applicant, we control for the value and age of the property, whether the household is engaged in entrepreneurial activity, monthly income from household entrepreneurial activity, whether the business is a registered enterprise, whether household rents part of their residence, and the total amount of other outstanding formal debt incurred between 1997 and 1999.[37]

To account for household utilities bill requirements, we include information on whether or not the household paid any electricity, water or phone bill the month before the survey along with amounts the household paid for each. To address the remaining loan requirements, we incorporate information on whether the household is renting part of their residence, whether the entrepreneurial activity has a registered tax number, and whether any household member belongs to a community financial group. Capacity to provide a co-signer is proxied by the number of adults in the household and sex of the household head. Finally, capacity to provide a property document is indicated by whether or not the household is a member of the treatment group (and therefore has a government property title), along with whether or not the household has an additional type of unregistered property document.

We also include in the empirical model basic pieces of household information that are likely to be observable to banks and possibly relevant to loan application decisions. These include: sex, age, literacy and education level of household head, whether or not the household reports experiencing an economic shock over the past year, whether or not the household applied previously for a loan from the same category of institution, the year of the loan application, the intended use of loan funds and the distance from the lender to the household. The last is relevant

[37] The value of the property is reported by the household head in the survey question "If you tried to sell you house now, what do you think it would sell for?"

for transaction cost considerations of the bank, while loan history could be important if use of collateral decreases with the length of relationship with the bank.[38]

The intended use of loan funds is relevant only for applications to private sector lenders, as loans to the Materials Bank are uniformly intended for housing construction while supplier credit is used only for the purchase of consumer goods.[39] Among applications to private sector banks, the purpose of the loan is important primarily for identifying risk associated with entrepreneurial credit. Among these loan applications, 34.3% are intended for housing construction, 38.7% for entrepreneurial activity, 8.1% for emergency needs, 2.0% for the purchase of household goods, 1% for the purchase of land, and 16.1% for other consumption. Table 6 shows that in the market for private sector loans, there is little difference between titled and untitled households in the composition of loan uses.

There are two ways of approaching the set of characteristics included in X_i. First, we could assume that the only information on the household that is available in the application decision is that which was explicitly required by the bank as reported by the household, and therefore only include the relevant household characteristics interacted with a dummy variable indicating whether or not the bank requested such information. The other possibility is to also include all household information unconditional on the required screening criteria of the bank. In light of dimensionality constraints in parametric models and the small sample sizes for each loan type, the regression estimates follow the parsimonious specification and include only the interaction terms and the short list of observables. Clearly, this model is appropriate only under the strong assumption that households report all information used by banks and that banks do not make use of information that was not requested. In light of the fact that additional information might be used by the bank but not required to process the loan along with the fact that a non-trivial number of loans involved unspecified "other" information, the propensity score estimates include all combinations of the relevant observables.[40]

[38] Berger and Udell (1995) provide evidence of this.
[39] We exclude two MB applications for entrepreneurial loans, which reflect a recent expansion in MB lending programs.
[40] Regression and probit results do not differ in terms of sign or magnitude of estimated treatment effects, although the probit estimates with full set of controls is imprecisely estimated and only weakly significant.

In the proceeding section, we further refine our estimates of mean difference between treatment and control groups using matching techniques.[41] In particular, titled households are matched to untitled households on the basis of the propensity score, defined as $P(x_i) = \Pr(D_i = 1|x_i)$ where x_i is a vector of pre-exposure control variables, generated by performing a logistic regression of the same determinants of credit access on program participation.[42] Propensity score balances the distributions of observed covariates between program participants and non-participants based on the similarity of their predicted probabilities of participation (Rosenbaum and Rubin, 1983). Rosenbaum and Rubin (1983) prove that if the D_i's are independent over all i, and outcomes are independent of participation given x_i (i.e. unobserved differences do not influence whether or not i participates), then outcomes are also independent of participation given $P(x_i)$, just as they would be if participation was assigned randomly. In other words, the strong ignoribility assumption holds and the differences in the outcomes between the control group and the participants can be attributed to the program. The main advantages to propensity score matching are to capture possible non-linearities in the treatment effects and control variables without increasing the dimensionality of the problem. Since lending decisions involve potentially complex interaction effects among observable borrower characteristics, it is arguably problematic to impose a parametric functional form linking program participation to outcomes.[43]

There are several ways to construct estimators based on the propensity score. Kernel matching compares each treated individual with a kernel weighted average of all comparisons, the weights assigned according to the propensity score. In the proceeding estimates, the kernel matching estimator is given by a Gaussian kernel function and standard errors are obtained by bootstrapping. We also present results from random draw nearest neighbor and stratified matching procedures for robustness.[44]

[41] Evidence that estimates based on matched sub-samples are generally less biased and more robust to alternative specifications than estimates with full samples is provided by Rubin and Thomas (2000).
[42] Several procedures for matching on the propensity score can be used, a good review can be found in Heckman, Ichimura, Smith, and Todd (1998). Here we estimate the propensity score with predicted values from a probit model. We did not find significant differences in the distribution of covariates within strata.
[43] See Jalan and Ravallion (2002) for a discussion of this problem.
[44] See Ichino (2002) for a description of these matching methods.

Among the pool of approved loans, we also examine differences across treatment and control groups in the average interest rate, the size of the loan obtained, and the difference between amount requested and received. The corresponding OLS and matching estimates are presented alongside the loan approval estimates.[45]

4 Results

Table 7 reports the average treatment effect of property titling from the regression and probit estimates. Table 8 presents the propensity score estimates for the same outcomes.

4.1 Materials Bank Loans

In both tables we see a strong positive relationship between the likelihood that loan requests to MB are approved and whether the household has received a property title from the government program. The probit estimate in column 1 of Table 7 indicates a 4.6 percentage point increase in the likelihood that a loan application to MB is approved, implying a reduction in the rejection rate of nearly 50%. Furthermore, when the treatment effect is interacted with whether or not the document was requested by the bank in column 2 of Table 7, we observe that the entire treatment effect is concentrated among households that were asked to provide a title. Among the 40% of MB loan applicants that were not explicitly asked to provide property titles in the loan transaction, the treatment effect is close to zero and insignificant, a strong indication that the availability of property titles is indeed responsible for the increase in the loan approval rate associated with the titling program.

The estimated treatment effect of property ownership on MB loan approval rates from propensity score matching suggests an even larger improvement in loan approval rates of between 9 and 10 percentage points. The difference between the estimated treatment effects from probit and propensity score models is likely due to the exclusion of treatment group members who have no well-defined match among the control group.[46] These unmatched households with property titles are intuitively those that would not have applied for a loan in the absence of the

[45] Clearly, loan terms and approval are determined simultaneously. Due to data limitations, here we avoid estimating a joint model of application outcomes and study differences in average terms as an inference tool useful for interpreting the approval outcomes.
[46] Approximately 10% of households fall outside the region of common support, so were unmatched.

program. The fact that the treatment effects inferred from matching techniques are significantly larger than parametric estimates suggests that these marginal applicants are characterized by below average approval rates. This would be the case, for instance, if there is a significant degree of accurate self-sorting in the credit market, such that households who believe they have a low chance of receiving credit and are correct in their assessment fail to apply.

In contrast to the loan approval outcome, the provision of a property title appears to have little effect on MB interest rates and loan amounts in both the probit and propensity score estimates. Although the mean interest rate is nearly two percentage points lower for titled borrowers, the difference is not significant.

4.2 Private Sector Loans

Based on the regression estimates in Tables 6a and 6b, the effect of property titles on the market for loans from private sector lenders is distinct from the market for MB loans. In column 3, the estimated treatment effect from the probit estimate indicates that the likelihood of loan approval does not change with land ownership. The propensity score results are larger than the regression estimates but insignificant. In addition, the average size of private loans to titled households is around 50% larger, although the point estimate of the difference is not statistically significant. There are no significant or consistent differences between untitled and titled households in the difference between amount requested and received.

Meanwhile, all estimates from Tables 6 and 7 indicate that, conditional on approval, property owners face an 8-10 percentage point lower average interest rate on loans. This implies a reduction in the mean private sector interest rate from 27% to 18%. However, the treatment effect on interest rates does not appear to be explained by bank requirements on collateral provision, as measured by the small and statistically insignificant coefficient on the interaction term between treatment and the dummy indicator of title requirement in column 4 of Table 7.

4.3 Supplier Credit

As expected given that the supply of store credit is relatively unconstrained and loan prices are poorly captured by reported interest rates, we observe little evidence of a treatment effect of property titling on credit supply or loan contracts of supplier credit. The regression

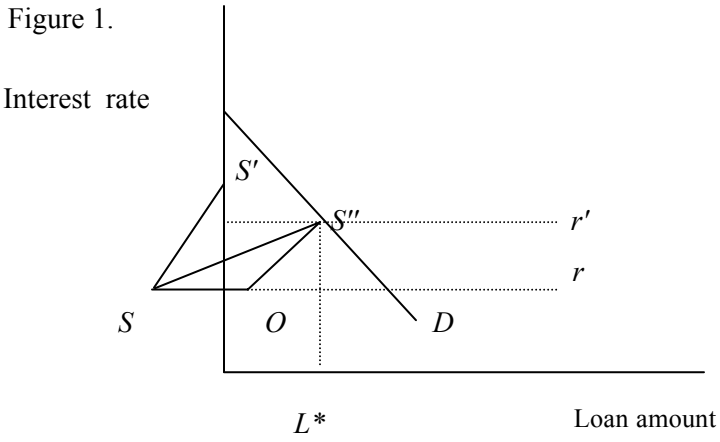
estimates of Table 7 find close to zero and insignificant effects of titling on any outcome related to store credit. In the propensity score estimates, we observe measurable effects on the interest rate from kernel matching, and a small change in the average loan size from nearest neighbor matching, but neither the sign nor significance of either result is robust to alternative matching techniques.

5 Discussion

In the case of MB credit, the absence of a large effect of property titling on interest rates conditional on receiving a loan is not surprising given that interest rates on MB loans are regulated by the government to fall within a range of two percentage points. The situation of the MB is analogous to a credit market model in which the bank is constrained by moral hazard issues from raising the interest rate above a certain level (indeed, this may well be the rationale behind the regulation), inducing quantity rationing of MB loans to exclude those that cannot provide sufficient collateral or surpass a certain level of default risk. In this market, collateral serves to reduce credit rationing by increasing the fraction of loan that is free of risk to the lender.

The absence of a strong relationship between MB loan size and ownership status is also not surprising given that loan amounts are also imprecisely restricted by bank lending rules, which state that amount is limited by the "particular construction needs of the household." Alternatively, differences in risk level inferred by the bank but not captured by the covariates could be responsible for the change in approval probability but not amount. As described by Wette (1983), in the presence of interest rate regulation, an increased use of collateral could generate adverse selection effects, depicted in Figure 1.

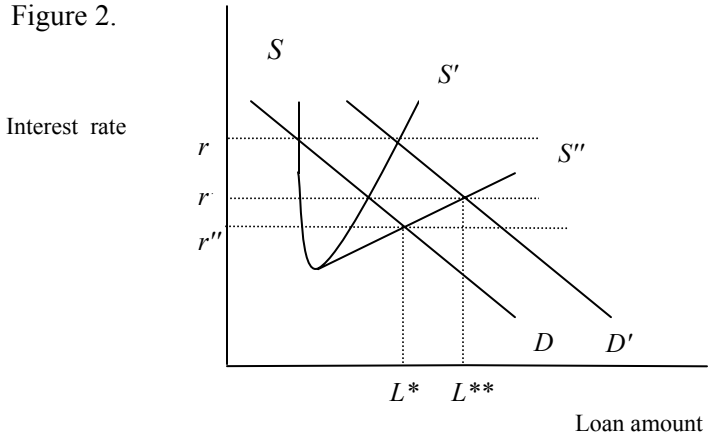
Figure 1.



Here, the supply curve originates in the negative orthant to reflect the fact that the collateral value of titled property net of transactions costs could be negative when land values are low. In this scenario, prior to the titling program, low risk types face the supply curve *SS″* while high risk types face *SS′*, so only low risk types are awarded loans of *L** at interest rate *r′*. When both types can provide collateral, the aggregate supply curve becomes *SOS″*, where the slope of the non-securitized portion of the supply curve (*OS″*) lies between the slope of the low-risk and high-risk types. Here, more loans are awarded, but the average loan amount provided remains at *L** and the interest stays fixed at *r′*. Hence, if MB applicants post-reform are on average considered riskier because the availability of collateral induces high risk types to enter the market, given that they face the same interest rate ceiling, a higher fraction will be awarded loans but the average interest rate and loan amount could remain the same.

The results for private sector lenders are more ambiguous given that private sector interest rates do not appear to depend on whether or not banks use property as collateral. As mentioned in Section 2, one possibility is that private sector banks do not find it profitable to use land as collateral (i.e. the expected effective leverage ratio of capital is non-positive), but do infer lower default risk from ownership rights and possession of a property title. This situation is illustrated in Figure 2.

Figure 2.



In this picture, there is no flat portion of the supply curve, indicating that banks are not using property titles to securitize loans. However, because they do infer lower default risk from the existence of a property title, the supply curve for program participants shifts from *SS′* to *SS″*, lowering the interest rate facing titled borrowers from *r* to *r′*. The downward-sloping portion of the supply curve reflects the fact that effective interest rates are higher for small loans due to costs involved in processing and monitoring loans. While in this scenario, the average loan size also shifts outward from *L** to *L*** which is inconsistent with our estimates, if the demand curve is steeply sloped, the change in quantity demanded would be small relative to the change in the interest rate. It is also reasonable to assume that, given the increased availability of low-interest MB loans for title owners post-reform, the demand curve for more expensive commercial loans shifts inward for a given household. In this case the interest rate would fall even further to *r'*, while the change in quantity demanded at the new interest rate is ambiguous.

Unfortunately, with available data it is impossible to distinguish the case where banks infer low default risk from property ownership from unobserved heterogeneity in local financial markets. While the result on the private sector interest rate is robust to controlling for observed heterogeneity among private sector lender types, clearly the pattern could still be driven by unobservable differences in the lending practices or level of competition among financial institutions available to untitled and titled households. However, measures of aggregate banking activity from 1994 and 1996 nation-wide censuses of financial activity, including the number of ATMs and the number of bank employees by district show no differences in local financial sector development.

An important issue emerging from the findings is the source of the discrepancy in lending strategies across private and public sector banks. Given the strict lending practices of MB, it is not surprising that the interest rate response is distinct for MB and private sector banks. Unable to separate the market according to risk, MB must limit the amount of credit it provides to the untitled population – evidenced by the lower approval rates. Particularly since the pool of applicants for MB loans is on average more vulnerable to income shocks, it is reasonable that these banks would encounter greater moral hazard and enforcement constraints which make it unprofitable to adjust the interest rate, whereas commercial banks that face a less risky pool of applicants and also screen out a greater portion of applicants have more interest rate flexibility. Furthermore, it is unlikely that possessing a property title offers additional information on the default risk of MB borrowers precisely because they are borrowing for housing construction, and the bank could reasonably infer the same tenure security and low eviction likelihood from the fact that households are investing in immobile assets.

It is less clear why private sector lenders would not make use of property titles as collateral if MB finds it profitable to do so. One explanation is that quantity rationing will generally be size-biased in the sense that the profit on small loans net of transactions costs is lower, such that collateral is only cost effective for relatively large loans. Since MB loans are all for housing construction and tend to be fairly large – the mean amount is roughly $1421 – and the variance in loan size is small, a larger number of loans from non-MB sources will be rejected on account of the transactions costs involved in administering small loans. Collateral provision – which only increases loan transaction costs – cannot eliminate this type of quantity rationing.

Another explanation is that regular banks perceive the transactions costs involved in using government land titles as collateral to be greater than does MB, related to the fact that, as a public sector bank, MB could have inside information regarding the extent to which the government is willing to enforce property collection in the case of default. Furthermore, because MB is a government entity, it may have moved more swiftly to integrate its lending policies with the new property registry.[47] This is the current opinion of titling program administrators, who in

[47] According to a sample of lenders interviewed by Fleisig and de la Pena (1996), "public registries seem expensive to search, not sufficiently open to public access, and technically weak. The problems raise the cost of registering security interests in small real estate holdings." Furthermore, "there are altogether about twelve registries important for filing security interest against different types of collateral … the

response to the low rate of mortgages on COFOPRI titles have taken an initiative to develop training programs for private sector bank managers to teach them how to access ownership information using the new property registry.[48] If transactions costs involved in verifying ownership status are a major component of the cost to banks of using collateral, when such knowledge spreads to the private sector, banks may indeed follow the lead of MB and increase the frequency with which they use property as collateral.

A final possibility is that, as a public sector institution, MB is subsidizing loans, and in fact, not offering profitable loan contracts to clients. Furthermore, the public bank may by characterized by greater corruption or the misuse of funds for political gain. Indeed, early reports of high default rates among MB borrowers suggest that loans may be distributing according to other criteria.[49] Further information on the profitability of MB loans and long-run private sector lending strategies is needed to disentangle these competing hypotheses.

6 Conclusions

Despite the distribution of over 1.2 million property titles, our results indicate that credit rationing is still a key feature of the micro-lending environment in urban Peru. In particular, post reform a full 34% of titled households remain fully rationed out of the formal credit market. These results shed light on the potential impact of titling efforts on financial market integration and development in poor urban communities worldwide. Although property titles are associated with a small reduction in formal sector credit rationing, it appears that titling efforts will not automatically make collateral-based lending viable for the majority of formal-sector credit applicants.

Most notably, our estimates suggest that the bulk of the reduction in credit rationing associated with the Peruvian urban titling program can be attributed to one particular lending institution, the publicly-funded Materials Bank that supplies in-kind loans of housing construction materials. Meanwhile, the degree of credit rationing among private sector lenders

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separate registries do not link their information in any way. Therefore parties must incur high costs in order to check several registries for claims against collateral."

[48] Personal interview with Daniel Andaluz, August 14, 2002, COFOPRI office, Lima, Peru.

[49] In conjuction with the increase in default rates, the bank's own financial assessment, (Banco de Materiales, "Evaluacion a Junio 2003") suggests overall operating losses and declining profitability for the past year.

appears unaltered by a wide-scale titling program. However, although shortly after the titling program private sector banks do not appear to find it profitable to securitize loans with titled property, our evidence suggests that private sector lenders may be incorporating information on default risk into loan contracts to lower the interest rates for titled borrowers.

The fact that credit access for construction materials improves with ownership rights is important insofar as it helps meet the increased demand for housing investments that accompanies improvements in tenure security. In this manner, greater access to MB loans should reduce the dampening effect on other types of investments that will result if demand for construction materials rises while households remain credit constrained in financing home improvements.[50] However, given that access to loans for purposes other than housing does not appear to have changed with ownership status, post-program titled households will still be unable to rely on credit as a source of consumption insurance in the case of emergency financial needs. This is exaggerated by the fact that MB loans are in-kind transfers of construction materials, and hence not fungible in the case of unexpected changes in consumption needs.

Perhaps more importantly, property titling does not appear to assist poor households finance micro-enterprise activities. This pattern is clearly illustrated in Table 9, which presents the loan approval rates for titled and untitled households according to the designation of credit. Consistent with the regression and matching estimates, we see that the entire improvement in loan approval rates is concentrated among construction loans, while all other categories of credit use have nearly identical approval rates for titled and untitled households. For instance, the means in the table indicate that liquidity constraints are still binding on entrepreneurial loans for titled households. Given that collateralizable wealth is an important determinant of small business formation (Black et al., 1996), if post-reform titled property cannot serve as collateral, land titling will have no effect on socially inefficient allocations of entrepreneurial activity across socioeconomic groups. As a result, the growth implications of strengthening property institutions may be greatly overstated.

[50] See Carter and Olinto (2002) for a formal presentation of this relationship.

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Table 1: Summary Statistics

	All Households			*Households requesting any formal loan*		
	Untitled	Titled	$\|t_8\|$	Untitled	Titled	$\|t_8\|$
N:	*1067*	*536*		*420*	*253*	
Characteristics of Household						
Number of working-age members	4.27	4.15	1.12	4.32	4.25	0.45
Number of members	5.35	5.28	0.61	5.52	5.50	0.06
Number of children aged 5-11	0.87	0.88	0.08	0.98	0.98	0.04
Number of children aged 12-16	0.65	0.59	1.19	0.69	0.65	0.50
HH head female	0.23	0.23	0.04	0.18	0.20	0.85
Age of HH head	48.7	48.7	0.05	46.9	46.6	0.22
HH head literate	0.93	0.93	0.51	0.95	0.95	0.06
Head highest grade primary school	0.37	0.42	1.80	0.32	0.36	0.95
Head highest grade high school	0.44	0.43	0.34	0.48	0.49	0.33
Head highest grade college	0.07	0.06	0.32	0.08	0.08	0.27
Monthly wage HH head	673.2	603.6	1.31	729.4	630.0	0.99
Total monthly consumption	549.4	548.2	0.06	575.4	574.3	0.04
Food expenditures/bi-monthly	190.1	190.4	0.06	195.0	195.1	0.02
Education expenditures/year	422.7	403.7	0.66	476.7	439.6	0.81
Transportation expenditures/month	64.5	75.7	1.61	68.9	85.3	1.23
Whether HH savings	0.08	0.08	0.15	0.10	0.09	0.36
HH extreme poor	0.28	0.25	1.02	0.22	0.19	0.81
Characteristics of Residence						
Whether rent part of residence	0.03	0.03	0.02	0.03	0.04	0.49
Years of residence	1982.7	1981.4	1.31	1984.2	1982.7	1.40
Whether telephone	0.20	0.18	0.78	0.23	0.20	1.10
Whether home business	0.24	0.26	0.65	0.29	0.32	0.83
Income from home business	332.8	279.0	1.59	335.5	256.4	1.51
Average formal lender distance	3.82	4.11	1.24	4.65	4.85	0.64
Closest bank there two years ago?	0.95	0.96	0.50	0.94	0.95	0.52
HH Lending Behavior						
Would accept formal sector loan	0.59	0.73	4.43			
Asked for formal sector for loan	0.39	0.47	2.32			
Request any informal	0.10	0.10	0.02	0.15	0.13	0.78
Fraction of total credit informal	0.16	0.13	1.06	0.07	0.04	1.32
HH Housing Improvements						
Housing improvements 1997-1999	0.46	0.56	2.83	0.63	0.76	2.95
Improvements financed with formal credit	0.18	0.30	4.09	0.42	0.60	3.70
Housing improvements ever	0.75	0.83	2.62	0.87	0.95	3.06
Asked for construction loan	0.37	0.51	4.94	0.60	0.74	3.46

Table 2: Degree of Credit Rationing

	Did not apply for a loan			*Applied for a loan*		
	Would accept	Would not accept				
	fully quantity rationed: self-sorting	fully quantity rationed: risk rationed	price rationed	fully quantity rationed	partially quantity rationed	price rationed
Untitled	0.202	0.110	0.290	0.026	0.142	0.231
[N]	[239]	[129]	[342]	[31]	[167]	[272]
COFOPRI title	0.256	0.069	0.203	0.015	0.218	0.239
[N]	[137]	[37]	[109]	[8]	[117]	[128]
t (	-2.47	2.62	3.79	1.46	-3.98	0.38
Pearson (^{2} = *36.72*						

Table 3: Sources of Credit

	All	*Untitled*	*COFOPRI*	$\|t_{-}\|$
N:	*854*	*574*	*280*	
Materials Bank	0.352	0.310	0.435	2.83
Other formal lender	0.213	0.254	0.189	2.07
Commercial supplier	0.209	0.221	0.186	1.09
Informal lender	0.207	0.215	0.190	0.88
Composition of other formal lenders				
Commercial bank (fully regulated)	0.544	0.525	0.597	1.01
Savings and loan organization (fully regulated)	0.327	0.343	0.284	0.88
Credit cooperative (fully regulated)	0.057	0.061	0.045	0.48
EDPYME (semi-regulated)	0.012	0.011	0.015	0.25
NGO/village bank (unregulated)	0.060	0.060	0.059	0.03
Composition of informal lenders				
ROSCA	0.329	0.358	0.253	1.54
Local moneylender	0.092	0.079	0.121	0.97
Family	0.222	0.237	0.195	0.67
Friend	0.130	0.135	0.121	0.36
Street vendor	0.227	0.191	0.311	1.98

Table 4: Summary Statistics of Applicants by Lender Type

	Commercial bank requests			*Materials Bank requests*			*Supplier/store credit requests*		
	Untitled	Titled	$\|t_{\neg}\|$	Untitled	Titled	$\|t_{\neg}\|$	Untitled	Titled	$\|t_{\neg}\|$
N:	*158*	*60*		*220*	*154*		*148*	*62*	
Characteristics of Household									
Number working-age members	4.32	4.63	1.09	4.20	4.18	0.11	4.19	4.08	0.39
Number members	5.35	5.77	1.31	5.49	5.40	0.41	5.43	5.61	0.61
Number children aged 5-11	0.84	0.95	0.84	1.08	0.95	1.18	1.01	1.19	1.35
Number children aged 12-16	0.62	0.78	1.27	0.74	0.62	1.32	0.59	0.63	0.25
Household head female	0.13	0.13	0.01	0.17	0.19	0.43	0.26	0.27	0.17
Age of household head	47.3	46.6	0.47	45.2	45.9	0.42	46.6	48.5	0.76
Household head literate	0.97	0.98	0.70	0.95	0.95	0.20	0.93	0.90	0.57
Head highest grade primary	0.23	0.18	0.86	0.32	0.40	1.49	0.35	0.39	0.44
Head highest grade high school	0.47	0.68	2.92	0.50	0.44	1.19	0.43	0.47	0.55
Head highest grade college	0.12	0.13	0.26	0.07	0.07	0.05	0.11	0.06	1.04
Monthly wage household head	763.0	631.2	1.00	784.8	650.4	0.78	603.1	584.4	0.36
Total monthly consumption	630.4	691.1	0.75	519.0	523.6	0.15	604.8	590.0	0.35
Food expenditures/month	212.2	214.8	0.20	179.5	187.0	0.75	207.5	207.2	0.02
Education expenditures/year	683.9	573.6	0.66	371.7	400.4	0.62	432.1	455.7	0.36
Transportation expenditures/mnth	78.7	138.3	1.16	57.1	60.7	0.62	74.6	77.1	0.30
Whether household savings	0.09	0.15	0.87	0.07	0.09	0.53	0.16	0.07	1.78
Household extreme poor	0.08	0.07	0.23	0.28	0.23	0.89	0.19	0.15	0.15
Characteristics of Residence									
Whether rent part of residence	0.03	0.02	0.70	0.05	0.02	1.47	0.01	0.10	2.26
Years of residence	1984.6	1982.1	1.44	1986.3	1983.4	2.31	1984.9	1981.4	1.86
Whether telephone	0.32	0.30	0.26	0.16	0.19	0.56	0.19	0.10	1.57
Whether home business	0.32	0.38	0.85	0.28	0.29	0.15	0.24	0.34	1.05
Income from home business	434.5	391.3	0.37	280.8	260.8	0.37	293.7	111.0	3.80
Average formal lender distance	5.23	6.03	1.33	4.19	4.35	0.43	5.33	5.44	0.17
Closest bank there two yrs ago?	0.94	1.00	2.62	0.95	0.95	0.16	0.93	0.95	0.36
HH Lending Behavior									
Number of loans requested	1.34	1.38	0.41	1.21	1.13	1.56	1.37	1.32	0.49
Request any informal	0.11	0.15	0.74	0.10	0.08	0.70	0.32	0.31	0.23
Fraction of total credit informal	0.04	0.04	0.05	0.03	0.01	1.21	0.16	0.14	0.33
Loan offered?	0.898	0.866	0.66	0.909	0.987	3.40	0.993	0.999	1.00
Average credit amount difference	-117.7	-242.8	0.72	-184.5	-543.0	1.02	-0.16	-0.07	1.01
Size of loan	2773.3	2414.3	0.65	3702.6	3768.5	0.24	456.6	266.6	1.34
Interest rate	0.32	0.20	3.76	0.09	0.07	1.35	0.03	0.02	1.23

Table 5: Loan Requirements

Credit source:	Materials Bank	Commercial Bank	Supplier Credit
N:	*614*	*548*	*266*
Nothing, just reputation	0.003	0.106	0.652
Personal identity document	0.982	0.821	0.303
Property title	0.599	0.429	0.113
Utilities bill	0.503	0.454	0.175
Reported self-worth	0.375	0.299	0.075
Co-signer	0.345	0.285	0.132
Wage receipt	0.269	0.347	0.145
Other	0.246	0.179	0.087
Solidarity group membership	0.083	0.020	0.019
Priomisory note	0.072	0.089	0.071
Business registration documents	0.031	0.078	0.011
Household items (collateral)	0.016	0.040	0.009
Bond	0.016	0.038	0.004
Tax receipt	0.015	0.051	0.004
Operating license	0.015	0.041	0.000
Rental contract	0.003	0.003	0.000

Table 6: Loan Uses and Approval Rates

	All loan applications		*Private sector loan applications*	
Credit source:	Untitled	COFOPRI title	Untitled	COFOPRI title
N:	*524*	*277*	*524*	*277*
Household items	0.073	0.076	0.017	0.030
Housing construction	0.445	0.545	0.359	0.328
Entrpreneurial activity	0.153	0.083	0.381	0.403
Emergency	0.071	0.043	0.088	0.060
Other	0.260	0.253	0.155	0.179

Table 7: OLS Regressions, Credit Supply

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	Offered given applied		Interest rate offered		Amount received		Difference b/t amount asked and received	
Materials Bank loans								
COFOPRI title	0.046**	0.012	-0.010	-0.015	-216.26	-113.14	399.59	-215.51
	(0.010)	(0.030)	(0.015)	(0.019)	(219.05)	(307.40)	(480.49)	(470.70)
Property documents required*COFOPRI title		0.057**		0.011		-325.03		1342.86
		(0.024)		(0.022)		(403.03)		(992.63)
Other formal loans								
COFOPRI title	0.002	0.000	-0.085*	-0.102*	-25.83	614.71	54.02	247.82
	(0.061)	(0.017)	(0.041)	(0.048)	(684.69)	(715.37)	(119.31)	(192.12)
Property documents required*COFOPRI title		-0.062		0.038		-1435.43		-434.31
		(0.082)		(0.063)		(1107.56)		(260.27)
Supplier loans								
COFOPRI title	0.000	0.000	-0.008	-0.006	110.35	106.50	0.128	0.084
	(0.000)	(0.000)	(0.014)	(0.013)	(100.57)	(102.35)	(0.304)	(0.309)
Property documents required*COFOPRI title		0.000		-0.014		192.87		2.210
		(0.000)		(0.147)		(858.88)		(2.59)

Notes: First two columns are probit estimates, all remaining are OLS regressions.Standard errors are in parentheses. Robust standard errors account for sample clustering and stratification.

Demographic controls include: age, literacy, and degree level of HH head; whether residence used as source of economic activity, total monthly household wage income, monthly earnings of highest wage earner, whether highest wage earner self-employed, whether worker with greatest work hours self-employed, monthly earnings of highest contracted employee, and fraction of household wages from contracted employment; self-reported sale value and age of property, whether household is engaged in entrepreneurial activity, monthly income from household entrepreneurial activity, whether business has a registered tax number, whether household rents part of residence, and total amount of other outstanding formal debt between 1997 and 1999; whether or not paid any electricity, water or phone bill last month and amounts paid for each; whether household member belongs to local financial group, number of adults, and dummy indicating household has an additional type of unregistered property document; whether economic shock over past year, whether applied previously for a loan from the same category of institution, year of the loan application, intended use of loan funds and distance from the lender.

Table 8: Propensity Score Estimates

Matching method:	(1) kernel matching	(2) nearest neighbor	(3) stratified matching
Materials Bank loans			
Loan application approved	0.094**	0.104**	0.093**
(*Bootstrapped SE*)	(0.028)	(0.036)	(0.029)
Amount offered	-328.66	-121.67	119.63
(*Bootstrapped SE*)	(364.00)	(392.05)	(287.17)
Difference in amount requested and received	-656.09	36.75	-127.52
(*Bootstrapped SE*)	(1072.25)	(692.64)	(596.32)
Interest rate	-0.017	-0.021	-0.017
(*Bootstrapped SE*)	(0.012)	(0.016)	(0.014)
Other formal loans			
Loan application approved	0.047	0.036	0.051
(*Bootstrapped SE*)	(0.036)	(0.123)	(0.036)
Amount offered	1494.3	789.0	1654.0
(*Bootstrapped SE*)	(1708.0)	(1200.5)	(1744.2)
Difference in amount requested and received	108.34	126.53	79.37
(*Bootstrapped SE*)	(65.08)	(61.29)	(105.20)
Interest rate	-0.087*	-0.101*	-0.097*
(*Bootstrapped SE*)	(0.043)	(0.047)	(0.041)
Supplier loans			
Amount offered	-258.8	36.29*	-166.5
(*Bootstrapped SE*)	(190.43)	(18.55)	(98.6)
Difference in amount requested and received	-0.268	-0.196	-0.092
(*Bootstrapped SE*)	(0.22)	(0.50)	(1.02)
Interest rate	-0.029*	-0.005	-0.020
(*Bootstrapped SE*)	(0.009)	(0.004)	(0.022)

Notes: ** p<0.01; * p<0.05; Demographic controls same as those listed in notes to Table 6. Nearest neighbor matching in column 2 is random draw.

Table 9: Loan Approval Rates according to Use of Credit

Credit source:	Untitled	COFOPRI title
N:	*614*	*548*
Household items	1.000	1.000
Housing construction	0.890	0.950
Entrpreneurial activity	0.900	0.890
Emergency	1.000	1.000
Other	0.980	0.980

Appendix 1: OLS Regressions, Credit Applications

	(1)	(2)	(3)	(4)	(5)
Universe:	All formal loans	Construction loans	Materials Bank loans	Supplier loans	Other formal loans
COFOPRI title	0.067*	0.099**	0.104**	0.060*	0.034
	(0.032)	(0.027)	(0.028)	(0.028)	(0.027)