

# THE WORLD BANK ECONOMIC REVIEW

Volume 22 • 2008 • Number 3

## A SYMPOSIUM ON ACCESS TO FINANCE

Access to Finance: An Unfinished Agenda  
*Thorsten Beck and Asli Demirgüç-Kunt*

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Use around the World  
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# Access to Finance: An Unfinished Agenda

*Thorsten Beck and Asli Demirgüç-Kunt*

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Recent data compilations show that many poor and nonpoor people in many developing countries face a high degree of financial exclusion and high barriers in access to finance. Theory and empirical evidence point to the critical role that improved access to finance has in promoting growth and reducing income inequality. An extensive literature shows the channels through which finance promotes enterprise growth and improves aggregate resource allocation. There is less evidence at the household level, however, and on the effectiveness of policies to overcome financial exclusion. The article summarizes recent efforts to measure and analyze the impact of access to finance and discusses the unfinished research agenda. JEL codes: G2, G21, O16

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Financial markets and institutions emerge to alleviate market frictions arising from information asymmetries and transaction costs. A substantial theoretical and empirical literature shows the importance of efficient financial systems for long-term economic development (see Levine 2005 for a survey). Recent evidence shows that financial development is both pro-growth and pro-poor. Countries with deeper financial systems grow faster and reduce income inequality and poverty headcounts faster (Beck, Demirgüç-Kunt, and Levine 2007). However, most of the empirical cross-country literature on the impact of financial development focuses on financial depth, using measures such as total outstanding deposits or credits. Only recently have researchers turned their attention to questions of financial outreach and inclusion—the extent to which households and firms can access and use formal financial services.

What is the degree of financial exclusion across countries, and what drives the variation? Does improved access have an impact on individual welfare, enterprise growth, and aggregate economic growth and poverty reduction? And what policies are effective in expanding outreach and inclusion? As background work for the Policy Research Report on access to finance (World Bank 2007), a World

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Bank conference in March 2007 addressed these and related questions. This special issue contains several of the papers presented at the conference. This introduction summarizes the main findings of the conference in the broader context of recent advances in measuring and analyzing access to finance.

Theory suggests that financial exclusion acts as a brake on economic development. Many models point to poor people's lack of access to finance as inhibiting human and physical capital accumulation. This lack of access not only impedes growth, as many worthwhile investment projects cannot be realized, but also results in persistent income inequality (Galor and Zeira 1993; Banerjee and Newman 1993). Most development economists take these financial frictions as given and focus on fiscal redistribution to reduce income inequality and promote growth. But because lack of access to finance has a continuous impact on income inequality, such redistribution often has to be repeated, with negative repercussions for incentives to save and work (Aghion and Bolton 1997). By contrast, focusing on financial sector reforms that broaden access to financial services and reduce exclusion does not involve negative incentive effects and does not require permanent income redistribution. Building more inclusive financial systems also appeals to a wider range of philosophical perspectives than does implementing redistributive policies: redistribution aims to equalize outcomes, whereas better functioning financial systems serve to equalize opportunities (Demirgüç-Kunt and Levine 2007).

Recent cross-country evidence points to the positive impact that financial sector deepening can have on reducing income inequality and poverty. Specifically, Beck, Demirgüç-Kunt, and Levine (2007) show that countries with better developed financial systems experienced faster increases in the income share of the poorest quintile and faster reductions in income inequality, as measured by the Gini index, over the period 1960–2005. Further, countries with deeper financial systems experience faster reductions in the share of the population that lives on less than \$1 a day. This relationship is not only statistically, but also economically significant: almost 30 percent of the cross-country variation in changing poverty rates can be explained by variation in financial development.

Beck, Levine, and Levkov (2007) confirm the dampening effect that finance has on income inequality by exploiting the branch deregulation experience across U.S. states in the 1980s and 1990s. Exploiting differences across states over time, thus controlling for state- and time-fixed effects, and using income distribution data from one source while focusing on a specific policy change that was implemented almost exactly across states helps the authors address concerns related to cross-country regressions, such as measurement and endogeneity biases. Again, the effect of financial liberalization on income distribution is not only statistically, but also economically significant: more than 60 percent of the cross-state, cross-year variation in income distribution is explained by elimination of restrictions on branching.

Beck, Levine, and Levkov (2007) also explore the channels through which financial deepening reduces income inequality. Perhaps surprisingly, it was not

by broadening access to credit services or by advancing entrepreneurship that financial liberalization reduced income inequality. Rather, it was by boosting output and demand for labor, especially unskilled labor. Consequently, the wage and salary earnings of the unskilled and lower paid part of the labor force increased, both absolutely and relatively to the earnings of the skilled and higher paid part of the labor force, which in turn led to a tightening in income distribution.

Nor are these results specific to an industrialized country such as the United States. Giné and Townsend (2004) obtain similar findings for the Thai economy. Calibrating general equilibrium models with microdata taking into account labor market effects, they find that the main impact of finance on income inequality is indirect, working through the inclusion of a larger share of the population in the formal economy and higher wages rather than through the provision of direct access to credit for the poor.

These initial findings are tantalizing. They suggest that besides direct benefits of access, small firms and poor households can also benefit indirectly from the effects of financial development. They also suggest that pro-poor financial sector policy needs a broader focus than access for the poorest and that improving access by the excluded nonpoor micro and small entrepreneurs can have a strongly favorable indirect effect on the poor. The importance of access issues for development means that expanding access to financial services remains an important policy challenge capturing the attention of researchers and policymakers alike around the world.

The first section of the article presents recent efforts to measure financial outreach and exclusion. Section II discusses recent research on the importance of access to credit for firms, while section III focuses on access to financial services by households and microenterprises. Section IV discusses policy options to broaden outreach, and section V considers the unfinished research agenda.

## I. MEASURING FINANCIAL OUTREACH AND EXCLUSION

While time-series data on financial depth are readily available for a large cross-section of countries over a long period, data on the number of users and barriers to access to financial services have become available only recently. How many depositors are behind total deposits in a country's banking system? How many borrowers are behind total credit outstanding? What barriers prevent many people in developing countries from accessing formal financial services? It is important to distinguish between use and access in this context. Critically, nonusers of financial services can be differentiated into those who voluntarily exclude themselves because they do not need financial services, have religious or cultural reasons for not using the services, or have indirect access through friends and family, and those who are involuntarily excluded.

While those who have access but choose not to use services pose less of a problem for policymakers, since their lack of usage reflects their lack of

demand, it is important to distinguish among different groups of involuntarily excluded in order to formulate proper policy advice. First is the group of households and firms that are considered unbankable because their incomes are too low or they pose too high a lending risk. Rather than trying to include them in the financial system, nonlending support mechanisms might be more appropriate. Three other groups of involuntarily excluded call for specific policy actions, as their exclusion may be due to discriminatory policies, deficiencies in the contractual and informational frameworks, or inadequate price and product features.

Seeking to provide headline indicators of access to and use of financial services, Beck, Demirgüç-Kunt, and Martinez Peria (2007) collect data on the aggregate number of bank branches, automated teller machines, and bank deposit and loan accounts across up to 99 countries. They find some striking differences. Ethiopia has less than one branch per 100,000 people; Spain has 96. In Albania, there are four loans per 1,000 people; in Poland, there are 774. While only rough proxies, these indicators closely predict harder to collect micro-level statistics of household and enterprise use of banking services.

Honohan (2007) uses the number of bank loan and deposit accounts and similar statistics for microfinance and cooperative financial institutions to compute a synthetic headline indicator of access to finance. Specifically, extrapolating the relationship between the number of accounts and micro-survey-based measures of the proportion of households with a financial account for a small set of countries to a broad cross-section of countries with data on the number of accounts allows him to estimate the proportion of a country's population that has access to a financial account. These estimates provide a stark picture of cross-country differences in financial inclusion, ranging from Continental Europe, where more than 90 percent of the population has access to a financial account, to Sub-Saharan Africa, where less than 20 percent has.

Why do large proportions of the population in many developing countries not use financial services? Beck, Demirgüç-Kunt, and Martinez Peria (2008) survey the largest banks in 62 countries and document large differences in price and nonprice barriers associated with deposit, credit, and payment services. For example, in Cameroon, the minimum deposit to open a checking account in a commercial bank is more than \$700—higher than average GDP per capita. In South Africa and Swaziland, no minimum amounts are required. In Sierra Leone, annual fees to maintain a checking account exceed 25 percent of GDP per capita. In the Philippines, there are no annual fees. In Bangladesh, Pakistan, and the Philippines, it takes more than a month to get a small business loan processed. In Denmark, the wait is only a day.

The authors show that these types of barriers are negatively correlated with banking penetration and outreach and may prevent a large percentage of the population from using banking services in many countries. Specifically, back-of-the-envelope calculations show that annual checking account fees

alone exclude more than 90 percent of the population in several African countries from such accounts. Factors associated with financial depth such as the effectiveness of credit information sharing, creditor rights, and contract enforcement are highly correlated with barriers, but so are nonfinancial factors such as infrastructure development and the extent of media freedom. More competitive banking systems and market-based supervisory policies are associated with lower barriers. Contrary to conventional wisdom, government banks are not associated with lower access barriers. Instead, bank customers face higher barriers to credit services in banking systems that are predominantly government-owned, while a larger share of foreign bank ownership is associated with lower barriers in deposit services.

While such supply-side barriers are powerful in excluding large segments of the population in many developing countries, there might also be cultural barriers to using formal banking services, as Osili and Paulson (2008) show using data on immigrants in the United States. The authors examine the determinants of financial market participation among these immigrants, considering the influence of both individual-level factors (like wealth and education) and of the institutional environment in the country of origin. The authors find that immigrants from countries with institutions that more effectively protect private property and provide incentives for investment are more likely to have a U.S. bank account and to participate more extensively in U.S. financial markets. These effects are persistent, lasting at least 28 years after immigration, and are present even in immigrants who arrive in the United States as young children. These results suggest that institutional reform is likely to be an important tool for expanding access.

## II. FIRMS' ACCESS TO FINANCE

One of the critical channels through which finance promotes growth is the provision of credit to the most deserving firms. A large number of studies show the positive effect that financial development has on firms' growth, especially firms that need it most (Demirgüç-Kunt and Maksimovic 1998; Rajan and Zingales 1998). Finance helps firms overcome liquidity constraints and thus improve resource allocation in the economy (Love 2003; Wurgler 2000). The broad cross-country evidence is confirmed by individual case studies using detailed loan and borrower information. Specifically, Banerjee and Duflo (2004) study detailed loan information on 253 small and medium-size borrowers from an Indian bank before and after they became eligible for a directed credit program. The finding that these firms expanded after becoming eligible suggests that they had previously been credit constrained. The exogenous policy change is an important tool for the authors to disentangle the impact of access to credit on sales and profits from the impact of other, unobserved, enterprise characteristics on business performance.

An alternative method to identify the impact of access to credit on firm performance is through controlled experiments. McKenzie and Woodruff (2008) designed a field experiment in Mexico that administered treatments of cash or equipment to randomly selected microenterprises in their sample, hence generating shocks to capital stock that are uncorrelated with entrepreneurial ability or growth opportunities. Their results suggest returns to capital of 20–33 percent a month, which are much higher than market interest rates and even higher than returns from a similar experiment in Sri Lanka (de Mel, McKenzie, and Woodruff 2008). Furthermore, interacting the treatment effect with different measures of financial constraints and access to finance, they find that the return is much higher (70–79 percent per month) for firms that report themselves as financially constrained. Indeed, they cannot reject the possibility of no return for the financially unconstrained group of firms. Very high levels of return at very low levels of capital stock also imply that there may be no minimum investment threshold below which returns to capital are so low as to discourage entry into self-employment.

Access to finance favorably affects firm performance along a number of channels. Recent cross-country efforts to collect consistent firm-level survey data have allowed researchers to explore the mechanisms through which finance affects economic growth and the structure of the economy. Research using these firm-level surveys has shown that improvements in the functioning of the formal financial sector reduce financing constraints more for small firms (Beck, Demirgüç-Kunt, and Maksimovic 2005; Beck and others 2006; Beck and others, 2008). Research also indicates that access to finance promotes more start-ups and that smaller firms are often the most dynamic and innovative (Klapper, Laeven, and Rajan 2006). Better access to the financial system also enables incumbent firms to reach a larger equilibrium size by enabling them to exploit growth and investment opportunities (Beck, Demirgüç-Kunt, and Maksimovic 2006). Furthermore, greater financial inclusion allows the choice of more efficient asset portfolios and innovation (Claessens and Laeven 2004; Ayyagari, Demirgüç-Kunt, and Maksimovic 2007). Financial deepening can also increase incentives for firms to incorporate, thus reaping benefits from the resulting opportunities of risk diversification and limited liability (Demirgüç-Kunt, Love, and Maksimovic 2006).

How important is financial exclusion as a constraint to firm growth compared with other dimensions of the business environment, such as the macroeconomic environment, infrastructure, taxation, and security? In micro-surveys, firms generally point to multiple obstacles to their operation and growth, but it is not clear that all obstacles are equally binding. Ayyagari, Demirgüç-Kunt, and Maksimovic (2008b) use firm-level survey data to explore the relative importance of different features of the business environment. They find that only obstacles related to finance, crime, and political instability directly affect firm growth. Further sensitivity tests reveal that only access to finance is consistently and robustly linked to the performance of firms.

To what extent can informal financial institutions substitute for formal financial institutions? China is often mentioned as a counterexample to the findings in the finance and growth literature, since it is one of the fastest growing economies in the world despite the weaknesses in its banking system (see Allen, Qian, and Qian 2005). Using firm-level survey data, Ayyagari, Demirgüç-Kunt, and Maksimovic (2008a) find, however, that despite the financial sector weaknesses, financing from the formal financial system is associated with faster firm growth, whereas raising financing from alternative channels is not. Overall, the results suggest that even in fast growing economies like China, where the formal financial system serves only a small part of the private sector, the fastest growing firms depend on finance from the formal financial system. These findings suggest that the role of reputation- and relationship-based informal financing and governance mechanisms in supporting the growth of private sector firms is likely to be limited and unlikely to substitute for formal mechanisms.

### III. HOUSEHOLDS' ACCESS TO FINANCIAL SERVICES

There are many reasons why poor people do not have access to financial services, ranging from physical distance to discrimination and lack of education to high fees and minimum balances. Specifically, there are two important problems in access to credit services. First, the poor have no collateral and cannot borrow against their future income because they tend not to have steady jobs or income streams. Second, dealing with small transactions is costly for financial institutions. Johnston and Morduch (2008) show that many unbanked individuals in Indonesia, although judged creditworthy by microfinance professionals, seek loans that are too small to be profitable at common interest rates, even for an innovative microlender.

Microfinance institutions have tried to overcome these two constraints in innovative ways. Group lending schemes improve repayment incentives and monitoring through peer pressure and also build support networks and educate borrowers (Ghatak and Guinnane 1999; Karlan 2007; Karlan and Valdivia 2006). Increasing loan sizes, as customers continue to borrow and repay, reduces default rates. The effectiveness of these innovations in different settings is still being debated. Recently, many microfinance institutions have moved from group lending products to individual lending, especially where the borrowing needs of customers start to diverge. Initial evidence finds both techniques to be successful (Giné and Karlan 2006).

Although the attention in microfinance has traditionally focused on providing credit for very poor entrepreneurs, and although enthusiasts—such as Nobel Laureate Mohammed Yunus—often emphasize how microfinance unleashes the productive potential of borrowers, leading to increased productivity and growth, much of microcredit is not used for investment. Johnston and Morduch (2008) find that loans for small business are an important but

not predominant fraction of all loans. Low-income households in the survey use loans as often for household needs, including school fees, medical treatment, daily consumption needs, and social and holiday expenses.

What is the impact of microcredit on borrowers' welfare? While many heartening case studies are cited—from contexts as diverse as the slums of Bangladesh to rural Peru to the villages of Thailand—there are only a few rigorous studies that compare groups of borrowers with nonborrowers, controlling for individuals' characteristics and using eligibility criteria or random assignment as identification restrictions to overcome problems of unobserved borrower characteristics being correlated with outcomes. While some of these studies have shown a positive impact of access to credit (Karlan and Zinman, forthcoming), others have not (Coleman 1999), or the results depend on the econometric methodology applied (Pitt and Khandker 1998; Morduch 1998).

That a large share of microcredit clients use their loans for consumption rather than investment points to the absence of adequate savings instruments for these population segments. Research by Ashraf, Karlan, and Yin (2006 a,b,c) shows that innovative savings products such as deposits collected directly from customers and savings commitments can increase savings. Distance can be an important impediment to use of formal savings services by the poor, as Aportela (1999) shows for the case of a Mexican savings bank.

Most research exploring the impact of new methodologies and products on take-up and clients' welfare is based on "experiments," whether they exploit exogenous variation in implementation or eligibility criteria or they are controlled randomized experiments, where researchers control implementation. In controlled randomized experiments, clients are randomly assigned to a control or treatment group and only the treatment group gets access to the new program or product. Researchers can rigorously control for selection bias arising from certain clients selecting into the new program or product, and the treatment group constitutes a proper counterfactual. Although such controlled experiments have limitations, carefully planned and executed random experiments are a powerful tool of impact evaluation. On the downside are their very high costs, which prevent many microfinance institutions from using them, and concerns of external validity, or whether the results found in one specific geographic or socioeconomic environment can easily be applied to a different environment.

In contrast to the well-developed literature on microcredit, research on micro-insurance is still limited. In one of the few studies in this area, Giné, Townsend, and Vickery (2008) study barriers to household participation in micro-insurance products by documenting the institutional details and contractual features of an innovative weather insurance policy for small farmers in Southern India. They find that insurance take-up increases in the correlation between insurance payouts and the risk to be insured, and wealth, and decreases in credit constraints. They also find that inconsistent with theory, risk adverse households are less likely to buy the insurance product, potentially

suggesting that many households may be uncertain about the insurance product itself, given their limited experience with it. Similar results are reported by Giné and Yang (forthcoming) who find that farmers in Malawi are more likely to take up a credit-only product than a credit-plus-insurance product, which would allow them to forego repayment in case of drought or flooding.

Demand for payment services has also increased enormously over the past decades, especially for international remittances, a consequence of large migration flows. International remittance flows (funds earned by migrants abroad and sent to their families in developing countries) are now the second largest source of external finance for developing countries after foreign direct investment (World Bank 2005). Formal remittance services, however, are often costly, especially if competition is absent and senders lack knowledge of delivery options. Lack of bank penetration not only reduces competition, but also makes remittances more expensive, as a detailed study of the Tonga-New Zealand remittance channel shows (Gibson, McKenzie, and Rohorua, 2006). Recent studies on El Salvador and Mexico show, however, that remittance flows can pull new customers into the formal banking system (Aggarwal, Demirgüç-Kunt, and Martinez Peria 2006; Demirgüç-Kunt and others 2007).

#### IV. POLICIES TO BROADEN OUTREACH AND INCLUSION

The broad institutional framework plays an important role in expanding financial outreach and inclusion, as several articles in this symposium show. Osili and Paulson (2008) show that U.S. immigrants from countries with more developed institutional frameworks are more likely to use formal financial services, while Beck, Demirgüç-Kunt, and Martinez Peria (2008) show that barriers to banking are lower in countries with more competition and openness. However, institution building is a long and difficult process.

Recent research suggests that prioritizing institutional reforms may be possible, helping authorities make difficult choices. For example, empirical evidence suggests that in low-income countries, information infrastructure matters most for financial deepening, while enforcement of creditor rights is more important in high-income countries (Djankov, McLiesh, and Shleifer 2007). But even within the existing contractual framework, there are certain short-cuts. Procedures such as those related to collateral that enable individual lenders to recover on debt contracts are found to be more important in boosting bank lending in relatively underdeveloped institutional environments than procedures such as bankruptcy codes that are concerned mainly with resolving conflicts between multiple claimants (Haselmann, Pistor, and Vig 2005). Allowing loan repayment to be deducted directly from the borrower's payroll check can lower interest rates, as in Brazil, where banks provided payroll loans at significantly lower rates than regular consumer loans, which were subject to the slow and inefficient recovery procedures of the Brazilian legal system (Costa and de Mello 2006).

Bank regulation is also important. Beck, Levine, and Levkov (2007) show that branch deregulation in the United States led to less income inequality and higher earnings for low-skilled workers. Guiso, Sapienza, and Zingales (2006) study the impact of bank deregulation on access to and cost of finance using the 1936 Italian banking law and its repeal in the 1980s as a natural experiment. After deregulation, the provinces that had been more penalized by restrictions in competition experienced a higher than normal aggregate growth rate. These results emphasize the importance of bank regulation and its impact on competition in broadening access to finance.

A controversial topic in expanding access to finance is the role of state-owned institutions. The poor record of government development banks in delivering broad access weakens the case for using this tool on the credit side. However a handful of more sophisticated government-owned development finance institutions have moved away from credit to provide more complex financial services. Their know-how, willingness, and capacity to take initiatives that are consistent with a social remit has allowed them to introduce to developing countries products and markets that are proven elsewhere but that entail heavy set-up costs and often a lengthy initial period of loss-making, without the certainty of high financial return. Involving little or no credit risks, these services are less subject to the political subversion of state-provided credit. They can help overcome coordination failures, first-mover disincentives, and obstacles to risk sharing and distribution, with private–public partnerships.

De la Torre, Gozzi, and Schmukler (2007) illustrate this with three examples from Mexico. One is the electronic brokerage of reverse factoring developed by Nafin, a government development bank, which allows many small suppliers to use their receivables from large creditworthy buyers to receive working capital financing. Another example is the electronic platform implemented by BANSEFI, another government-owned institution, to help semiformal and informal financial intermediaries reduce their operating costs by centralizing back-office operations. The third example is a government-owned development finance institution turned investment bank, FIRA, which has brokered complicated structured finance products to realign credit risks with the pattern of information between financial intermediaries and participants in the supply chains for shrimp and other agro-fish products. Ultimately, with patient capital, private capital could have undertaken each of these successful initiatives. Indeed, the Mexican government explicitly envisages privatization of at least some of these initiatives. But they have had a useful catalytic function in kick-starting certain financial services.

## V. LOOKING FORWARD: AN UNFINISHED RESEARCH AGENDA

Recent advances in measuring and analyzing financial outreach and products for the poor, including the discussion in the articles in this symposium, have

provided important insights. In the past few years, researchers have developed the first estimates of financial outreach across countries, assembled ample evidence on the impact of finance on firm performance and the channels through which it works, and presented initial results on techniques and products to reach out to micro-borrowers and -savers. They have gained some insights on policies that help deepen and broaden financial systems. However, the agenda on access to finance is still unfinished.

First, the theory on the effect of financial sector reforms on opportunities faced by individuals needs to be expanded (Demirgüç-Kunt and Levine 2007). Financial sector reforms can avoid the negative incentive effects that come with redistribution; it is important to understand the channels through which financial sector reforms can have positive effects on opportunities and thus on economic development and poverty alleviation.

Second, more and better data are needed on financial outreach and inclusion. The first data sets described in section II provide some insights but have to be expanded—in numbers of both countries and institutions—and updated regularly. Building data sets that benchmark countries annually would help focus the attention of policymakers and allow them to track and evaluate efforts to broaden access. However, these aggregate surveys have to be complemented by household surveys that focus on household access to and use of different financial services from various institutions. Only combining such demand-side data with supply data from banks and other financial institutions will enable identifying the banked and the commercially bankable populations, as well as the bottlenecks that result in difference between the two groups (Beck and de la Torre 2007).

Third, more analysis is needed to better understand the channels through which financial deepening and inclusion help reduce income inequality and poverty. How important is direct provision of finance for the poor? Is it more important to improve the functioning of the financial system, and so to improve access to its existing enterprise and household clients, or is it more important to broaden access to the underserved (including the nonpoor, who are often excluded in many developing countries)? Initial evidence points to powerful trickle-down effects of financial deepening. Given that not only the poor but also large parts of the nonpoor middle class are excluded from efficient financial services, looking beyond microcredit might be necessary. But more research is needed.

Fourth, more rigorous impact evaluation of specific policy reforms offers promise. While some reforms are introduced in a way that allows researchers to overcome identification problems, in other cases, careful planning might allow randomized experiments to assess the effect. As more countries look for policies to increase financial inclusion in a market-friendly way, proper evaluation of government reforms can provide the much-needed guidance going forward.

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# Banking Services for Everyone? Barriers to Bank Access and Use around the World

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Maria Soledad Martinez Peria*

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Information from 209 banks in 62 countries is used to develop new indicators of barriers to banking services around the world, show their correlation with measures of outreach, and explore their association with bank and country characteristics suggested by theory as potential determinants. Barriers such as minimum account and loan balances, account fees, and required documents are associated with lower levels of banking outreach. While country characteristics linked with financial depth, such as the effectiveness of creditor rights, contract enforcement mechanisms, and credit information systems, are weakly correlated with barriers, strong associations are found between barriers and measures of restrictions on bank activities and entry, bank disclosure practices and media freedom, and development of physical infrastructure. In particular, barriers are higher in countries where there are more stringent restrictions on bank activities and entry, less disclosure and media freedom, and poorly developed physical infrastructure. Also, barriers for bank customers are higher where banking systems are predominantly government-owned and are lower where there is more foreign bank participation. Larger banks seem to impose lower barriers on customers, perhaps because they are better positioned to exploit economies of scale and scope. JEL codes: G2, G21, O16

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It takes more than \$700 to open a bank account in Cameroon—more than the country's GDP per capita. Fees to maintain a checking account exceed 25 percent of GDP per capita in Sierra Leone. More than four types of documents are required to open a deposit account in Bangladesh. It takes more than 20

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TABLE 2. Continued

Country	Physical access Locations to open deposit account (out of 3)	Affordability			Eligibility Number of documents to open checking account (out of 5)
		Minimum amount to open checking account (percent of GDP per capita)	Minimum amount to be maintained in checking account (percent of GDP per capita)	Annual fees checking account (percent of GDP per capita)	
Hungary	2.53	0.14	0	0.17	1.55
India	2	8.85	5.83	0	2.69
Indonesia	2.53	9.54	6.14	2.8	3.18
Israel	2	0	0	0.04	1.22
Jordan	1.93	16.55	1.73	0	2.04
Kenya	2.78	11.71	0	12.82	3.78
Korea, Rep.	2.11	3.32	0	0.06	1.94
Lebanon	1.58	4.22	4.22	1.96	2.54
Lithuania	2.71	0	0	0.01	1.59
Madagascar	1.95	38.86	0	5.15	2.94
Malawi	2	0	0	21.98	3.65
Malta	2	0.22	0	0	3.17
Mexico	2.18	1.11	0.9	0.43	2.8
Moldova	3	0	0	0.53	2.31
Mozambique	2	29.61	14.19	n.a.	1
Nepal	2.34	90.66	123.77	8.28	4.11
Nigeria	2.44	106.42	0	0.05	3.66
Pakistan	2	1.59	0.33	0	2.64
Peru	2	1.66	0	1.44	2.42
Philippines	2	14.54	14.54	0	3.17
Romania	2.3	0.03	0.02	0.4	1.28
Sierra Leone	1.42	51.63	8.81	26.63	4.02
Slovak Rep.	2.08	0.12	0.1	0.18	1.47
Slovenia	1.5	0.01	0.01	0.17	1.88
South Africa	2.27	0	0	2.13	3.45
Spain	1.53	0	0	0.19	1
Sri Lanka	1.8	15.76	4.77	0.73	2.62

Sweden	1.66	0	0	0	1
Switzerland	2	0	0	0.08	1.14
Thailand	2.48	6.74	0.31	n.a.	1.23
Trinidad and Tobago	2	1.37	1.28	0.35	4.29
Turkey	2.2	0	0	0.3	3.2
Uganda	2	51.12	1.73	24.88	4
Uruguay	1.75	1.77	0	2.05	3.28
Zambia	1.8	0	0	n.a.	4.28
Zimbabwe	n.a.	n.a.	n.a.	n.a.	n.a.
Minimum	1.21	0	0	0	1
5th percentile	1.53	0	0	0	1
Median	2	0.98	0	0.3	2.63
Average	2.14	12.27	5.02	2.49	2.57
95th percentile	2.71	60.7	16.72	15.57	4.28
Maximum	3	116.39	123.77	26.63	4.57

n.a. means not available because the banks that responded to the survey account for less than 30 percent of the market.

*Note:* The table reports several indicators of barriers to the use of deposit services. The indicators are weighted country-level averages, with bank-level data weighted using the share of each bank in the total deposits of all banks that responded. Variables in the table are defined in table A.1. Indicators are not reported for Algeria and Swaziland because they would represent only one bank.

*Source:* Authors' analysis based on data from their 2004/2005 bank survey.

TABLE 3. Barriers to Loan Services, 2004/2005

Country	Physical access Locations to submit loan applications (out of 5)	Affordability		Eligibility Days to process consumer loan applications
		Minimum amount consumer loans (percent of GDP per capita)	Fees consumer loans (percent of GDP per capita)	
Albania	2.03	214.29	7.17	9.64
Armenia	2	14.74	1.98	4.83
Australia	5	7.31	0.52	1
Bangladesh	2.12	25.7	0.23	9.44
Belarus	n.a.	3.28	0.89	8.06
Belgium	2.45	5.34	0	2.7
Bolivia	2.74	109	3.45	5.36
Bosnia and Herzegovina	2.73	18.54	1.47	5.36
Brazil	4.85	1.96	3.44	1
Bulgaria	3.42	14.24	1.45	4.88
Cameroon	2.14	78.53	6.21	4.87
Chile	5	8.29	0.88	3.84
Colombia	3.47	16.4	0.97	2.51
Croatia	3.43	3.9	1.76	2.42
Czech Rep.	3.13	10.22	0.7	1
Denmark	5	0	2	0.73
Dominican Rep.	4.67	13.02	0.82	1.84
Egypt	2.81	5.84	0.01	5.38
Ethiopia	2	178.16	0	5.41
France	4	n.a.	n.a.	4.87
Georgia	2.46	34.53	1.4	3.31
Germany	n.a.	n.a.	n.a.	n.a.
Ghana	2.63	111.94	2.04	9.5
Greece	5	11.99	2.3	1
Hungary	3.29	4.77	3.71	5.66

India	2.44	28.79	1.19	4.17
Indonesia	3.1	31.68	n.a.	4.94
Israel	4.58	n.a.	n.a.	1
Jordan	2.05	147.67	1	2.68
Kenya	3.27	186.42	1.84	2.52
Korea, Rep.	3.78	4.19	0.37	1.88
Lebanon	4.6	32.95	1.05	1.58
Lithuania	4.25	6.31	0.71	2.41
Madagascar	2.16	24.06	2.62	8.55
Malawi	2.12	222.36	1	1.72
Malta	4.2	19.26	0.45	1.34
Mexico	4.2	7.54	1.81	5.01
Moldova	2.54	31.11	2.05	1.36
Mozambique	2.15	30.71	n.a.	8.66
Nepal	2	1,153.17	0.94	3.71
Nigeria	n.a.	n.a.	n.a.	n.a.
Pakistan	3.09	146.71	0.14	20.71
Peru	3.21	21.08	1.83	1.94
Philippines	2.36	330.55	1.46	10.13
Romania	n.a.	n.a.	n.a.	n.a.
Sierra Leone	1.77	143.55	2.07	1.73
Slovak Rep.	3.64	10.26	n.a.	1.75
Slovenia	2.13	1.13	1.22	1.13
South Africa	5	7.27	0.48	1.46
Spain	5	9.95	1.85	1
Sri Lanka	2.9	36.1	0.34	7.34
Sweden	n.a.	n.a.	n.a.	n.a.
Switzerland	3.12	0.11	0	1.44
Thailand	2	265.43	1.43	15.49
Trinidad and Tobago	4.62	7.71	1.33	1.33
Turkey	4.15	11.83	0.95	2.94

(Continued)

TABLE 3. Continued

Country	Physical access Locations to submit loan applications (out of 5)	Affordability		Eligibility Days to process consumer loan applications
		Minimum amount consumer loans (percent of GDP per capita)	Fees consumer loans (percent of GDP per capita)	
Uganda	2	205.75	2.68	1.38
Uruguay	2.26	32.62	n.a.	8.51
Zambia	2	n.a.	n.a.	n.a.
Zimbabwe	2.85	24.08	3.05	1.46
Minimum	1.77	0	0	0.73
5th percentile	2	1.63	0	1
Median	3.09	19.26	1.33	2.7
Average	3.2	76.84	1.58	4.29
95th percentile	5	239.59	3.61	9.79
Maximum	5	1153.17	7.17	20.71

n.a. means not available because the banks that responded to the survey account for less than 30 percent of the market.

*Note:* The table reports several indicators of barriers to the use of loan services. The indicators are weighted country-level averages, with bank-level data weighted using the share of each bank in the total deposits of all banks that responded. Variables in the table are defined in table A.1. Indicators are not reported for Algeria and Swaziland because they would represent only one bank.

*Source:* Authors' analysis based on data from their 2004/2005 bank survey.

TABLE 4. Barriers to Payment Services, 2004/2005

Country	Affordability		Country	Affordability	
	Cost to transfer funds internationally (percent of \$250)	Fee for using ATM Cards (percent of \$100 )		Cost to transfer funds internationally (percent of \$250)	Fee for using ATM Cards (percent of \$100)
Albania	7.70	0.00	Madagascar	4.30	0.00
Armenia	6.14	0.07	Malawi	6.42	0.08
Australia	8.05	0.00	Malta	5.59	0.03
Bangladesh	1.93	n.a.	Mexico	n.a.	0.40
Belarus	1.27	0.00	Moldova	11.19	0.00
Belgium	0.12	0.00	Mozambique	n.a.	n.a.
Bolivia	13.47	0.26	Nepal	7.10	0.00
Bosnia and Herzegovina	3.79	0.01	Nigeria	n.a.	0.50
Brazil	14.85	0.11	Pakistan	n.a.	0.60
Bulgaria	5.24	0.13	Peru	6.68	0.24
Cameroon	9.15	0.00	Philippines	n.a.	0.00
Chile	n.a.	0.00	Romania	n.a.	n.a.
Colombia	n.a.	0.19	Sierra Leone	6.86	0.00
Croatia	3.57	0.00	Slovak Rep.	4.38	0.19
Czech Rep.	3.99	0.19	Slovenia	2.88	0.00
Denmark	4.09	0.00	South Africa	9.53	0.34
Dominican Rep.	20.00	n.a.	Spain	6.39	0.00
Egypt	0.76	0.00	Sri Lanka	n.a.	n.a.
Ethiopia	1.87	0.00	Sweden	8.16	0.00
France	n.a.	n.a.	Switzerland	3.17	0.00
Georgia	7.03	0.13	Thailand	n.a.	n.a.
Germany	n.a.	n.a.	Trinidad and Tobago	3.74	0.05
Ghana	14.70	0.19	Turkey	6.34	0.00

(Continued)

TABLE 4. Continued

Country	Affordability		Country	Affordability	
	Cost to transfer funds internationally (percent of \$250)	Fee for using ATM Cards (percent of \$100 )		Cost to transfer funds internationally (percent of \$250)	Fee for using ATM Cards (percent of \$100)
Greece	7.42	0.00	Uganda	0.55	0.19
Hungary	3.60	n.a.	Uruguay	7.18	0.14
India	6.49	0.00	Zambia	3.24	0.13
Indonesia	2.83	0.00	Zimbabwe	n.a.	n.a.
Israel	n.a.	0.23	Minimum	0.12	0.00
Jordan	5.37	0.00	5th percentile	0.89	0.00
Kenya	8.43	0.15	Median	6.37	0.00
Korea, Rep.	7.05	0.22	Average	6.33	0.10
Lebanon	9.76	0.00	95th percentile	14.39	0.38
Lithuania	8.72	n.a.	Maximum	20.00	0.60
			Maximum	0.12	0.00

n.a. means not available because the banks that responded to the survey account for less than 30 percent of the market.

*Note:* The table reports several indicators of barriers to the use of payment services. The indicators are weighted country-level averages, with bank-level data weighted using the share of each bank in the total deposits of all banks that responded. Variables in the table are defined in table A.1. Indicators are not reported for Algeria and Swaziland because they would represent only one bank.

*Source:* Authors' analysis based on data from their 2004/2005 bank survey.

TABLE 5. Correlations between Barriers and Measures of Financial and Economic Development and Outreach

Barrier	GDP per capita	Private credit to GDP	Number of branches per 100,000 people	Number of loans per 1,000 people	Number of deposits per 1,000 people	Penetration (percent of adults with access to a financial institution)	Business constraint	
							Access to finance	Cost of finance
Number of places to open deposit account (out of 3)	-0.11	-0.02	-0.18	-0.38*	-0.22	-0.27**	-0.05	-0.05
Minimum balance to open checking account (percent of GDP per capita)	-0.29**	-0.32**	-0.29**	-0.34	-0.46***	-0.37***	0.33**	0.32**
Checking account annual fee (percent of GDP per capita)	-0.26*	-0.30**	-0.23	-0.20	-0.32*	-0.34**	0.37**	0.51***
Number of documents needed to open checking account (out of 5)	-0.42***	-0.35**	-0.40***	-0.19	-0.42**	-0.46***	0.46***	0.37**
Number of places to submit loan Application (out of 5)	0.47***	0.54***	0.45***	0.63***	0.43**	0.48***	-0.36**	-0.37**
Minimum amount consumer loan (percent of GDP per capita)	-0.24*	-0.24*	-0.21	-0.27	-0.37**	-0.28**	0.12	0.16
Fee consumer loan (percent of GDP per capita)	-0.21	-0.29*	-0.08	-0.13	-0.36**	-0.20	0.08	0.16

(Continued)

TABLE 5. Continued

Barrier	GDP per capita	Private credit to GDP	Number of branches per 100,000 people	Number of loans per 1,000 people	Number of deposits per 1,000 people	Penetration (percent of adults with access to a financial institution)	Business constraint	
							Access to finance	Cost of finance
Days to process consumer loan applications	-0.35***	-0.27*	-0.30**	-0.34	-0.33*	-0.33**	0.13	0.10
Cost to transfer funds internationally (percent of 250)	-0.16	-0.09	-0.11	-0.09	-0.28	-0.16	-0.04	0.06
Fee for using ATM card	-0.21	-0.16	-0.29*	-0.23	-0.38*	-0.26*	0.20	0.18

\*Significant at the 10 percent level; \*\*significant at the 5 percent level; \*\*\*significant at the 1 percent level.

*Note:* Pairwise correlation coefficients between barriers indicators, measures of financial and economic development and financial outreach. Variables in the table are defined in table A.1.

*Source:* Authors' analysis based on data from their 2004/2005 bank survey.

descriptive statistics, for barriers to access to and use of deposits, loans, and payments. Averages are reported for each country, calculated by weighting each bank's responses by its share of deposits in the total deposits of all sampled banks for indicators for deposit and payment barriers, and by the share of loans for indicators of loan barriers. Also, wherever possible, results are distinguished by three service dimensions: physical access, affordability, and eligibility.

### *Deposit Services*

The main deposit product considered is the checking (or transactions) account.<sup>5</sup> Weighted country-level averages are presented in table 2.

**PHYSICAL ACCESS.** Physical access to banking services can often be impeded by long distances to a bank outlet (Beck, Demirgüç-Kunt, and Martínez Peria 2007).<sup>6</sup> But even if there is a wide network of bank offices, they may not all offer the same services. Physical access to deposit services is measured by locations to open a deposit account. This indicator takes a value of 1 to 3 depending on whether an account can be opened at headquarters only (1), at headquarters or a branch (2), or at headquarters, branches, or nonbranch offices (3).<sup>7</sup> While the majority of sampled banks in Greece and Sierra Leone require customers to visit the head office to open a checking account, customers in Moldova can open an account at headquarters, branches, and even branch-like offices. In the median country, customers can open accounts at headquarters or branches but not at nonbranch offices.

**AFFORDABILITY.** Affordability of deposit services is characterized by the minimum balance required to open checking accounts plus the fees to maintain the accounts. There is substantial variation across countries in the ratio of the minimum balance needed to open a checking account to GDP per capita. In Cameroon and Nigeria, the minimum balance to open a checking account exceeds 100 percent of per capita income, and in Ethiopia, Nepal, Sierra Leone, and Uganda, it is more than 50 percent, but in 18 countries, less than half of them developed, there is no minimum balance. The median value for this indicator is 0.98 percent, and the average is 12.27 percent.<sup>8</sup>

Fees associated with maintaining a checking account also vary substantially. While in Malawi, Sierra Leone, and Uganda checking account fees are more

5. Since savings accounts are the dominant transaction account in some countries, table S.A.1 in the supplemental appendix also shows barriers related to savings accounts.

6. Lack of connectivity might also be a concern.

7. Only the most local office is considered. Banks that allow customers to open an account at a branch or a nonbranch office receive the same rating (3) as banks that allow customers to open an account at headquarters, a branch, or a nonbranch office.

8. While some of the variation in this indicator might be explained by the denominator—GDP per capita—the correlation between the amount needed to open an account and GDP per capita is far from perfect ( $-0.29$ ), and even in dollar terms, there is significant variation in minimum balances.

than 20 percent of GDP per capita, in Bangladesh, Belarus, Ethiopia, India, Jordan, Malta, Pakistan, Philippines, and Sweden checking accounts are free. The median value for these fees is 0.3 percent and the average is 2.5 percent.

**ELIGIBILITY.** Around the world, banks demand proof of identification to open an account for a new client. However, in many countries banks demand a variety of other documents besides identification cards, including recommendation letters, wage slips, and proof of domicile. While banks in Albania, Czech Republic, Mozambique, Spain, and Sweden demand on average only one document to open a checking account, banks in Bangladesh, Cameroon, Chile, Nepal, Sierra Leone, Trinidad and Tobago, Uganda, and Zambia require at least four documents.

### *Credit Services*

Indicators of physical access, affordability, and eligibility were collected for four loan types—consumer, small and medium-size enterprise, business, and mortgage. Because the interest here is products available to individuals, the focus is on consumer loans (table 3). (Indicators for the other loan types are reported in tables S.A.2 and S.A.3 in the supplemental appendix.) Indicators of physical access, affordability, and eligibility barriers are highly correlated with each other across loan types.

**PHYSICAL ACCESS.** Physical access to loans is measured using locations where loan applications can be submitted. Customers in Armenia, Ethiopia, Nepal, Sierra Leone, Thailand, and Uganda can apply for loans only at a bank's headquarters and branches. Customers in Australia, Chile, Denmark, Greece, South Africa, and Spain can apply not only at branch and nonbranch outlets, but also over the phone and the Internet. In the median and average country, bank customers can submit loan application at headquarters, branch, and branch-like offices.

**AFFORDABILITY.** Loan affordability is measured by the minimum amount for a consumer loan and the fees for these loans. The minimum amount for consumer loans ranges from less than 1 percent of GDP per capita in Denmark and Switzerland to 1,152 percent in Nepal. The median minimum amount for consumer loans is 19.3 percent as of GDP per capita, and the average is 76.9 percent. Fees on consumer loans expressed as a percent of GDP per capita range from zero in Belgium, Ethiopia, and Switzerland to more than 6 percent in Albania and Cameroon. The median fee on consumer loans is 1.3 percent of GDP per capita, and the average is 1.6 percent.

**ELIGIBILITY.** A crucial function of financial intermediaries is to screen borrowers. The number of days to process a loan application is a de facto eligibility barrier, since some borrowers might be discouraged from applying for bank loans and seek financing elsewhere to avoid long waiting periods. For

consumer loans, this indicator ranges from almost 1 day in Australia, Brazil, Czech Republic, Denmark, Greece, Israel, and Spain to more than 20 days in Pakistan. The average number of days to process a consumer loan application is 4, and the median is closer to 3.

### *Payment Services*

The indicators on payment services measure primarily affordability: the costs of transferring a small amount of funds internationally and the fees for using ATM cards (table 4).<sup>9</sup>

The cost of transferring funds internationally varies from 0.12 percent in Belgium to 20 percent in the Dominican Republic.<sup>10</sup> For comparability, a standardized transfer of \$250 is used. On average, the cost of transferring funds internationally is 6.3 percent of \$250, or \$15.82.

The fees associated with ATM transactions are expressed as a percent of \$100 dollars. ATM fees are more than 40 cents in Nigeria and Pakistan, and zero in half the countries in the sample. On average, the fees associated with an ATM transaction are 10 cents.

## III. BARRIERS TO BANKING AND OUTREACH

This section explores the association between the barrier indicators and measures of economic development, financial depth, and aggregate indicators of banking sector outreach (table 5). Examining these correlations provides a consistency check on the indicators and shows which barriers are actually constraining, in the sense that they are correlated with less banking sector outreach.

As expected, most of the barrier indicators are correlated with economic development, as measured by GDP per capita, and with the ratio of private credit to GDP, a standard indicator of financial depth. In general, higher barriers are correlated with less economic and financial development. The cost to transfer funds internationally or to use an ATM card and the locations to open deposit accounts are not significantly correlated with economic or financial development. This may be because countries at low levels of economic and financial development are leapfrogging, using the same alternative delivery channels and cheaper technology to provide deposit and ATM services as more developed countries.

Recently compiled data on branch penetration, number of loan and deposit accounts per capita (Beck, Demirgüç-Kunt, and Martinez Peria 2007), and a synthetic indicator of the proportion of the adult population with access to a financial account (estimated using existing household surveys and information on accounts from banks, cooperatives, and microfinance institutions; Honohan

9. Though ATM cards can be used for transactions such as transferring funds across accounts, the ATM cards are considered here primarily as facilitating payments by allowing fund withdrawals.

10. While we also considered the speed of transfers in terms of days, we found little variation across banks and countries.

2007) were used to gauge the relation between barriers and aggregate measures of financial sector outreach.<sup>11</sup> The correlations suggest that lower barriers are indeed associated with greater outreach (see table 5). Specifically, the numbers of loans, deposits, and branches per capita are higher in countries where customers face fewer barriers to the use of banking services in the form of high minimum balances, fees, or required documents.

Finally, the association between barriers and financing obstacles as reported by firms is documented through firm-level responses to two survey questions: “Is access to financing (collateral) a problem to the operation and growth of your enterprise?” and “Is cost of financing (interest rates) a problem to the operation and growth of your enterprise?” from the Investment Climate Assessment surveys conducted by the World Bank in 38 (access) and 39 (cost) countries. Responses to these questions are coded from zero (no obstacle) to four (very severe obstacle), with higher values indicating more severe financing constraints.<sup>12</sup> On average, firms report higher financing obstacles in countries where banks impose higher barriers to the use of their services. Firms’ financing obstacles are more significantly correlated with barriers related to deposit services than with barriers related to payment or loan services. This suggests that firms rely not only on credit services, but on a whole array of financial services from financial institutions.

But correlations do not imply causality. They suggest that barriers to banking go hand in hand with less physical access to banking offices and lower use of deposit and credit services by households and firms. However, they also show that some of the indicators capture barriers more effectively than others. Minimum account balances and account fees, minimum loan amounts, document requirements, reduced number of delivery channels for loan products, and long loan processing times seem to be significant barriers to accessing banking services, as evident in lower financial sector penetration rates. Loan fees, fees for international wire transfers and the use of ATM cards, and geographic access barriers to opening deposit accounts are either not significant barriers because they can be circumvented through technological advances and other means or they are not properly measured by the current methodology, as they do not seem correlated with lower financial sector penetration rates.

#### IV. WHAT EXPLAINS BANKING BARRIERS ACROSS BANKS AND COUNTRIES?

Theory suggests that barriers to banking arise from banks’ rational business decisions based on their business model; their market position; the

11. Though following Beck, Demirgüç-Kunt, and Martinez Peria (2007) in referring to branches per capita as a measure of outreach, lack of access to a branch could also be thought of as a barrier to banking.

12. There is a growing literature that shows the importance of financing obstacles for firm growth and financing patterns (Beck, Demirgüç-Kunt, and Maksimovic 2005; Ayyagari, Demirgüç-Kunt, and Maksimovic 2008).

macroeconomic, contractual, and regulatory environment in which they operate; and the competitive pressures they face (Berger and Udell 2006; Beck and de la Torre 2007). Barriers can thus be an optimal solution in a second-best world. This section explores the empirical association between the barrier indicators and an array of bank- and country-level variables. Bank-level data are from BankScope, and country-level variables are drawn from various databases.<sup>13</sup>

The following regression model is used to assess the association between barriers and bank- and country-level characteristics:

$$F_{i,k} = \alpha_0 + \alpha_1 B_i + \alpha_2 C_k + \varepsilon_{i,k} \quad (1)$$

where  $F$  is one of the barrier indicators for bank  $i$  in country  $k$ ,  $B$  is a matrix of bank-level variables (the log of total assets in U.S. dollars, dummy variables for government and foreign ownership, and the loan to asset ratio),  $C$  is a country-level variable, and  $\varepsilon$  is the error term. Clustered standard errors are reported at the country-level (allowing for correlation between error terms of banks within countries). While all bank variables are included in the regressions, only one country-level variable is included at a time because of the limited number of countries in the sample and the high correlation between the variables. Critically, the regression does not control for GDP per capita, because primary interest lies in knowing which components of economic development can explain cross-country variations in barriers, as captured by individual country characteristics. Finally, GDP per capita is excluded because many of the explanatory country-level variables are highly correlated with economic development (See table S.A.6 in the supplemental appendix.) Instead, to verify whether the results are sensitive to including different income groups, developed countries are dropped from the sample, leaving the focus on developing countries only. These results, available in table S.A.7 in the supplemental appendix, largely confirm the findings discussed below and shown in table 6.

Estimation techniques vary according to the nature of the dependent variable. Specifically, ordinary least squares (OLS) regressions of the log of one plus the variable are used for all affordability indicators—constructed as minimum amounts and fees relative to GDP per capita—to account for the skewed distribution of these variables. OLS regressions on the level of the indicators are used for days to process loans and number of documents required to open an account. Ordered probit estimations are used for the location variables (for loans and deposits) capturing physical access, to take account of the polychotomous nature of these variables with natural order. In all cases, the top 1 percent

13. Bank ownership data are from Micco, Panizza, and Yañez (2007), based on BankScope data. Appendix table A.1 provides definitions and sources for the explanatory variables included in the analysis. Tables S.A.5 and S.A.6 in the supplemental appendix present descriptive statistics and correlations for all explanatory variables.

TABLE 6. What Explains Barriers? Bank-Level Regression Results

Variable	Locations to open deposit account (out of 3)	Minimum balance to open checking account (percent of GDP per capita)	Annual checking account fees (percent of GDP per capita)	Number of documents needed to open checking account (out of 5)	Locations to submit loan application (out of 5)	Minimum amount consumer loan (percent of GDP per capita)	Fees consumer loans (percent of minimum loan amount)	Days to process consumer loan applications	Cost to transfer funds internationally (percent of \$250)	Fee for using ATM card (percent of \$100)
Bank-level government-owned bank dummy variable	-0.049 (0.254)	-0.004 (0.206)	-0.102 (0.093)	0.051 (0.059)	-0.313 (0.242)	0.032 (0.310)	-0.157 (0.143)	0.135 (0.133)	-0.037 (0.145)	0.028 (0.044)
Bank-level foreign-owned bank dummy variable	-0.237 (0.234)	-0.334 (0.310)	0.793*** (0.217)	0.081 (0.082)	-0.044 (0.229)	0.361 (0.303)	0.056 (0.104)	-0.155 (0.110)	0.183 (0.168)	0.025 (0.029)
Bank-level loans to assets	0.005 (0.608)	-0.385 (0.728)	-0.127 (0.393)	0.286 (0.228)	1.232** (0.544)	0.063 (0.866)	-0.564* (0.304)	0.607* (0.312)	-0.005 (0.413)	0.029 (0.091)
Bank-level log(assets)	0.024 (0.050)	-0.223*** (0.064)	-0.109*** (0.029)	-0.038*** (0.013)	0.250*** (0.045)	-0.286*** (0.065)	-0.033 (0.025)	-0.072*** (0.026)	0.033 (0.032)	-0.003 (0.005)
Electric power transmission and distribution losses (percent of output)	0.022* (0.013)	0.020 (0.025)	0.012 (0.008)	0.009 (0.006)	0.005 (0.013)	0.051** (0.022)	0.013** (0.006)	0.012 (0.011)	0.028*** (0.007)	0.003 (0.003)
Cost of enforcing contracts (percent of debt)	0.000 (0.004)	0.008 (0.011)	0.011** (0.005)	0.003** (0.001)	-0.001 (0.005)	0.013 (0.008)	-0.001 (0.002)	0.002 (0.003)	0.000 (0.002)	0.000 (0.001)
Legal rights index	0.075* (0.043)	-0.157** (0.068)	-0.012 (0.042)	-0.034* (0.019)	-0.060 (0.049)	-0.004 (0.087)	0.020 (0.027)	-0.024 (0.031)	-0.041 (0.044)	0.006 (0.009)
Credit information index	0.100 (0.085)	-0.062 (0.107)	-0.024 (0.070)	-0.033 (0.024)	0.129** (0.054)	-0.125 (0.097)	-0.003 (0.032)	-0.037 (0.031)	0.098** (0.046)	0.004 (0.012)
Bank concentration	-1.382** (0.562)	-0.961 (1.165)	0.422 (0.490)	-0.214 (0.196)	0.004 (0.734)	-1.501 (1.046)	-0.421 (0.340)	-0.868** (0.384)	-0.239 (0.443)	-0.142 (0.097)

Government bank share	-0.003 (0.005)	-0.003 (0.008)	-0.002 (0.003)	-0.002 (0.002)	-0.014*** (0.005)	0.011 (0.010)	-0.001 (0.003)	0.008*** (0.003)	0.006 (0.004)	-0.001 (0.001)
Foreign bank share	0.011** (0.005)	-0.008 (0.006)	-0.006** (0.003)	-0.004*** (0.001)	0.000 (0.005)	-0.01 (0.008)	0.002 (0.002)	0.003 (0.003)	-0.003 (0.003)	0.001 (0.001)
Fraction of entry applications denied	-0.005 (0.004)	0.009* (0.005)	0.006 (0.004)	0.003** (0.001)	-0.004 (0.004)	0.015** (0.007)	-0.003 (0.002)	0.005 (0.003)	0.000 (0.003)	0.001 (0.001)
Index of banking restrictions	-0.176 (0.134)	0.393** (0.183)	0.205* (0.108)	0.126*** (0.035)	-0.365*** (0.118)	0.344* (0.175)	0.040 (0.061)	0.127** (0.058)	-0.003 (0.079)	0.025 (0.029)
Index of banking disclosure practices	0.019* (0.011)	-0.011 (0.017)	-0.021*** (0.008)	-0.008** (0.003)	0.013* (0.008)	0.008 (0.017)	-0.008* (0.004)	-0.011** (0.005)	0.002 (0.007)	-0.004* (0.002)
Fraction of media owned by government	-0.910*** [0.310]	1.494*** [0.531]	0.384 [0.414]	0.268** [0.107]	-0.997*** [0.339]	0.499 [0.626]	-0.126 [0.185]	0.439*** [0.124]	-0.419 [0.318]	-0.060 [0.051]

\* Significant at the 10 percent level; \*\*significant at the 5 percent level; \*\*\*significant at the 1 percent level.

Note: Table shows the results from regressing each barrier indicator against the four bank-level variables (*Government-owned bank dummy*, *Foreign-owned bank dummy*, *Loan to assets ratio*, and *Log of total assets*) along with one country level variable at a time. The first four rows report the results of a regression on just the bank-level variables, while all subsequent rows report the results of adding the country-level variables one at a time. Regressions are estimated with OLS in all cases except that ordered Probit models are estimated for the *Number of places to open a deposit account* and the *Number of places to submit a loan application*. Numbers in parentheses are clustered standard errors at the county level. Variables in the table are defined in table A.1.

Source: Authors' analysis based on data from their 2004/05 bank survey.

of the distribution of the dependent variables is dropped to control for outliers. The first four rows of table 6 report the results of a regression on just the bank-level variables (that is, excluding country characteristics). The remaining rows report the results of adding the country-level variables one at a time, while still controlling for the bank characteristics. Thus, starting from row 5, each cell presents the result of one regression, controlling for the bank-level variables.

### *Bank Characteristics*

Theory provides opposing views on the impact of bank size and ownership types on barriers. On the one hand, large banks might be better at exploiting scale and scope economies, thus more easily overcoming the problem facing financial systems in large parts of the developing world that have clients with demands for small and few transactions and have few customers over which fixed transaction costs can be spread (Beck and de la Torre 2007). On the other hand, small banks, because of their size, might be closer to “smaller” and riskier clients and thus better able to serve them (Berger, Hasan, and Klapper 2004).

While public interest theory (Gerschenkron 1962) justifies the creation of government-owned banks to serve the small and riskier clients ignored by private financial institutions, a large theoretical and empirical literature suggests mission drift by these banks (La Porta, Lopez-de-Silanes, and Shleifer 2002), with opposing implications for the barriers imposed by government-owned banks. Similarly, while foreign-owned banks are assumed to be more interested in large corporations and private clients with demand for large transactions due to their limited access to soft local information (Mian 2006), they might have more efficient technologies, which allows them to lower cost and thus barriers (Berger and Udell 2006). And even if foreign banks do not serve the smaller clients themselves, the competitive pressures they create might provide incentives for the domestic banks to do so, hence lowering barriers (Rajan 2006).

The size of banks is measured as the log of total assets in millions of U.S. dollars, with ownership type controlled for by separate dummy variables for majority government- and foreign-owned banks. Finally, the loan-asset ratio is used as a proxy for the degree to which banks serve retail clients to explore the association of barriers with banks’ business orientation (Laeven and Levine 2007).<sup>14</sup> The conjecture is that banks with a retail orientation will impose lower barriers to attract a larger number of smaller clients, while wholesale or corporate banks might place higher barriers to signal their lack of interest in such clients.<sup>15</sup>

14. There could be reverse causation from higher barriers affecting banks’ balance sheets and so causality is not implied.

15. As suggested by an anonymous referee, the impact on barriers of other bank characteristics, such as net interest margins, overhead costs, and profitability, was also examined (see table S.A.8 in the supplemental appendix). These variables are not significantly associated with barriers and are also likely to be endogenous.

The results suggest that larger banks impose lower barriers to accessing deposit and lending services, perhaps because these banks are better positioned to take advantage of scale and scope economies. With respect to ownership types, the results show that with the exception of higher account fees, foreign ownership is not associated with significantly higher barriers than those of private domestic banks. At the same time, customers of government-owned banks do not face significantly lower barriers. In fact, government ownership has no statistically significant association with any of the barriers. Finally, the correlation between business orientation and barriers is mixed. While retail, loan-intensive banks—those with a higher ratio of loans to assets—are more likely to accept loan applications through nontraditional channels and seem to charge lower fees on consumer loans, they take longer to process loan applications. Overall, these results suggest that size is the dominant (most consistently significant) bank characteristic associated with variations in barriers and that scale economies and scope play a potentially important role.

### *Contractual and Informational Framework*

Banks arise to overcome information asymmetries between lenders and borrowers (Diamond 1984, 1991; Ramakrishnan and Thakor 1984; Boyd and Prescott 1986), which can lead to adverse selection and moral hazard problems. However, how well they are able to overcome these asymmetries depends on the contractual and informational framework in which they operate. An extensive empirical literature has shown the importance of effective contractual and informational frameworks for financial sector depth (for example, Beck and Levine 2005). There is empirical evidence that this relationship also holds for financial sector penetration and access to finance (Beck, Demirgüç-Kunt, and Levine 2005; Haselmann, Pistor, and Vig 2005; Visaria 2006; Beck, Demirgüç-Kunt, and Martinez Peria 2007). To explore whether contractual, legal rights, and informational frameworks are associated with bank barriers, three indicators are used from the Doing Business database (World Bank 2006a) that measure the efficiency of credit information systems, the legal rights of creditors in corporate reorganization and bankruptcy, and the cost of contract enforcement relative to GDP per capita.

The results not only uncover a weak association between barriers and the informational and contractual environment, but also, surprisingly, show that the link is mainly with deposit and not credit services.<sup>16</sup> Banks in countries with more efficient systems of credit information sharing impose lower barriers only in the number of places where applicants can request loans.<sup>17</sup> Banks in

16. The more significant correlation of these variables with deposit rather than credit barriers could indicate that there is less international competition on the deposit side. On the other hand, the credit barriers refer to consumer loans, traditionally a locally provided product. More research is needed to explore this.

17. On the other hand, surprisingly, banks in countries with better informational environments seem to charge higher fees on international wire transfers.

countries that more effectively protect creditors are more likely to allow customers to open bank accounts in nonbranch locations and to require lower minimum balances and fewer documents to open a checking account. Banks in countries with poor systems of contract enforcement charge higher fees on deposit accounts and require more documents to open accounts.

### *Market Structure*

Theory suggests an ambiguous relation between market structure and barriers to banking. Banks in more concentrated banking systems might either exploit their market power, imposing higher barriers, or face higher incentives to lend to smaller, more opaque borrowers such as small and medium-size enterprises from which they can recover their investment in the relationship in future periods (Petersen and Rajan 1995). Further, the variation of barriers across countries might be affected by the dominance of government-owned or foreign-owned banks in a banking system, with banks imposing higher or lower barriers in banking systems dominated by government-owned or foreign-owned banks independent of the individual bank's ownership type. Specifically, competitive pressures from a predominantly government-owned or foreign-owned banking system—or its absence—can push individual banks toward higher or lower banking barriers.

Data from Barth, Caprio, and Levine (2004) are used to assess the association between bank ownership and market structure and barriers to banking. Lower barriers to deposit services are found in banking systems with greater foreign bank presence. In systems that are predominantly government-owned, however, bank customers face greater restrictions on where to apply for loans and how long it takes to process applications. Finally, banks in countries with more concentrated banking systems are less likely to allow customers to open deposit accounts outside headquarters, but are faster at processing loan applications. Hence, overall there is no consistent relationship between market structure and barriers.

### *Regulatory Restrictions on Bank Activities and Entry*

Bank regulations might have both a direct and indirect effect on the barriers that banks impose. Some barriers, such as document requirements, might result directly from regulatory requirements. In other cases, banks may pass regulatory costs on to customers. Two indicators are used to gauge the association of bank barriers with regulatory policies. One is the index of banking restrictions from the Heritage Foundation, a composite index of whether foreign banks are able to operate freely, the difficulty of opening domestic banks, the degree of regulation of financial market activities, the presence of state-owned banks, whether the government influences credit allocation, and whether banks are free to provide customers with insurance products and invest in securities. The other is the fraction of bank applications denied, a direct measure of restrictions on bank entry collected by Barth, Caprio, and Levine (2004).

Banks in economies with more restrictions on banking activities are found to impose higher barriers to accessing deposit and lending services. Similarly, in less contestable systems, as proxied by a higher share of new bank license applications rejected, banks require higher minimum account balances and demand more documents to open accounts and higher minimum consumer loan balances.<sup>18</sup> The findings on the association between barriers and restrictive regulatory policies match those of other studies that find that such policies limit financial development and efficiency (Barth, Caprio, and Levine 2004; Beck, Demirgüç-Kunt, and Levine 2006; La Porta, Lopez-de-Silanes, and Shleifer 2006).

### *Transparency*

More transparent banking systems and societies might promote lower barriers to banking, since banks in economies where greater disclosure is mandated or observed or where clients have more access to information might have less leeway to impose high barriers to banking. More transparency might also imply more competition, since customers can more easily compare products across banks. Two indicators are used to assess the relationship between transparency and bank barriers. One is an index of banking disclosure practices developed by the World Bank (2006b), which seeks to quantitatively measure the disclosure practices of commercial banks around the world in relation to their assets, liabilities, equities, incomes, and risk profiles. The other is an indicator of lack of media freedom, which measures the share of press outlets owned by the government. This indicator comes from Djankov and others (2003), who show a negative association between this and other measures of media freedom and economic and political freedom.

In countries where banks tend to disclose more information about their operations, banks have more locations where individuals can open deposits or apply for loans, and annual checking deposit and consumer loan fees are lower. In countries with less media freedom (where a greater share of press outlets are controlled by the government), banks restrict the locations where accounts can be opened, impose higher minimum balances to open accounts, require more documents to open checking, take longer to process loan applications, and are less likely to accept loan applications through nontraditional channels.

### *Physical Infrastructure*

While the literature has paid surprisingly little attention to the relations among infrastructure, input costs, and financial depth and breadth, the results suggest

18. H statistics were also used as indicator of competitiveness, following the approach of Claessens and Laeven (2004). No significant relationship was found for this indicator and barriers. Regulatory indicators of formal bank entry requirements were also tried and again no consistent correlations with bank barriers were found.

that the quality of physical infrastructure (such as electricity networks), which is associated with the costs of doing business for banks, can help explain the cross-country variation in many barriers to banking. Electric power transmission and distribution losses as percentage of output (Estache and Goicoechea 2005) are used to assess the association of physical infrastructure with banking barriers. Banks in countries with more power outages impose higher minimum loan amounts and charge higher fees on consumer loans and on international wire transfers.

## V. CONCLUSIONS

This article is, to the authors' knowledge, the first comprehensive effort to systematically document the extent of barriers to banking services across countries, show their correlation with measures of outreach, and explore their association with a number of bank and country characteristics that are expected to drive barriers. Though more research is needed (especially to better establish causality), the findings have a number of policy implications. In particular, policies directed toward easing restrictions on banking activities and entry, increasing banking disclosure and transparency, and improving physical infrastructure should lower barriers. Less government ownership and more foreign bank participation is expected to enhance competition and also help bring down barriers.

As a first attempt at capturing quantitative measures of cross-country differences in barriers to banking along the dimensions of physical access, affordability, and eligibility, this article complements other efforts to collect data on access to financial services at the aggregate, firm and household levels. Research on financial access is still in its inception, and richer data sources and in-depth analysis are needed to improve the measurement and understanding of access and its impact on economic outcomes.

APPENDIX

TABLE A.1. Variable Definitions and Sources

Variable	Definition	Source
Locations to open deposit account	The indicator takes a value of 1 if account can be opened at headquarters only, 2 if at headquarters or a branch, and 3 if at headquarters, branches or a nonbranch outlet. The indicator varies from 1 to 3 depending on the number of locations available.	Authors' calculation based on survey information
Minimum amount to open checking account	Minimum balance required to open a checking account expressed as percent of GDP per capita.	Authors' calculation based on survey information
Minimum amount to be maintained in checking account	Minimum balance required to maintain a checking account expressed as percent of GDP per capita.	Authors' calculation based on survey information
Annual fees checking account	Fees associated with maintaining a checking account expressed as percent of GDP per capita.	Authors' calculation based on survey information
Number of documents to open checking account	Documents needed to open a checking account include identification, payment slip, letter of reference, proof of domicile, and any 'other' document a bank requires. The indicator varies from 1 to 5 depending on the number of documents required.	Authors' calculation based on survey information
Locations to submit loan applications	The indicator takes a value of 1 if application can be submitted at headquarters only, 2 if at headquarters or a branch, 3 if at headquarters, branches or a non-branch outlet, 4 if at headquarters, branches, nonbranch outlets or electronically; and 5 if at headquarters, branches, nonbranch outlets, electronically, or over the phone. The indicator varies from 1 to 5 depending on the number of locations available.	Authors' calculation based on survey information
Minimum amount consumer loans	Lowest amount of consumer loan banks make expressed as a percent of GDP per capita.	Authors' calculation based on survey information

(Continued)

TABLE A.1. Continued

Variable	Definition	Source
Fees consumer loans	Fees banks charge on consumer loans expressed as percent of GDP per capita.	Authors' calculation based on survey information
Days to process consumer loan applications	Number of days banks take to process a typical consumer loan application.	Authors' calculation based on survey information
Cost to transfer funds internationally	Amount of fee banks charge to transfer funds internationally expressed as percent of US\$250.	Authors' calculation based on survey information
Amount of fee for using ATM Cards	Amount of fee banks charge consumers for using an ATM card expressed as percent of US\$100.	Authors' calculation based on survey information
GDP per capita	GDP at US dollars at market exchange rate/Total population.	World Development Indicators
Private credit to GDP	Private credit by deposit money banks and other financial institutions as share of GDP.	World Bank Financial Structure and Economic Development Database
Number of branches per 100,000 people	Number of branches per 100,000 people.	Beck, Demirgüç-Kunt, Martinez Peria (2007)
Number of loans per 1,000 people	Number of loans per 1000 people.	Beck, Demirgüç-Kunt, Martinez Peria (2007)
Number of deposits per 1,000 people	Number of deposits per 1000 people.	Beck, Demirgüç-Kunt, Martinez Peria (2007)
Penetration	Share of households with bank accounts (percent).	Honohan (2007)
Business constraint: access to finance	Access to finance as a constraint to business operation and growth reposted on a scale of 0 through 4, where 0 = no obstacle and 4 = very severe obstacle.	Enterprise Surveys (World Bank/International Finance Corporation)
Business constraint: cost of finance	Cost of finance as a constraint to business operation and growth reposted on a scale of 0 through 4, where 0 = no obstacle and 4 = very severe obstacle.	Enterprise Surveys (World Bank/International Finance Corporation)
Bank-level government-owned bank dummy variable	Dummy variable equal to 1 if bank is state owned.	Micco, Panizza, Yanez (2007)
Bank-level foreign-owned bank dummy variable	Dummy variable equal to 1 if bank is foreign owned.	Micco, Panizza, Yanez (2007)
Bank-level loans to assets	Ratio of bank's total loans to assets.	BankScope Database (August 2006). Fitch Ratings/Bureau van Dijk

Bank-level log(assets)	Natural log of bank's total assets.	BankScope Database (August 2006). Fitch Ratings/ Bureau van Dijk
Electric power transmission and distribution losses (percent of output)	Technical and nontechnical losses. Includes electricity losses due to operation of the system and the delivery of electricity as well as those caused by unmetered supply. This comprises all losses due to transport and distribution of electrical energy and heat. It also includes losses in transmission between sources of supply and points of distribution and in the distribution to consumers, including pilferage.	Estache and Goicochea (2005)
Credit information index	Scored on a 0–6 scale, with scores increasing with the availability of credit information. Index measures rules affecting the scope, access, and quality of credit information.	World Bank (2006a)
Costs of enforcing contracts	Total enforcement cost, including legal fees, assessment, and court fees expressed as a percentage of total debt.	World Bank (2006a)
Legal rights index	Scored on a 0–10 scale, with scores increasing with legal rights. Index measures the degree to which collateral and bankruptcy laws facilitate lending.	World Bank (2006a)
Bank concentration	Share of deposits in the five largest banks.	Barth, Caprio, and Levine (2004)
Government bank share	The extent to which the banking systems assets are government owned (50 percent or more).	Barth, Caprio, and Levine (2004)
Foreign bank share	The extent to which the banking systems assets are foreign owned (50 percent or more).	Barth, Caprio, and Levine (2004)
Fraction of entry applications denied	The degree to which applications to enter banking are denied.	Barth, Caprio, and Levine (2004)
Index of banking restrictions	Index captures government's control, regulations, and involvement in financial sector. Higher values indicate more banking restrictions.	Index of Economic Freedom 2006. The Heritage Foundation/The Wall Street Journal

(Continued)

TABLE A.1. Continued

Variable	Definition	Source
Index of banking disclosure practices	Index seeks to quantitatively measure the actual disclosure practices of commercial banks around the world, in relation to their assets, liabilities, equities, incomes, and risk profiles.	World Bank (2006b). See <a href="http://www.ifc.org/ifcext/corporategovernance.nsf/AttachmentsByTitle/Global_Assesment_Bank_Disclosure_Practices+/\$FILE/Bank+Disclosure+Index.pdf">http://www.ifc.org/ifcext/corporategovernance.nsf/AttachmentsByTitle/Global_Assesment_Bank_Disclosure_Practices+/\$FILE/Bank+Disclosure+Index.pdf</a>
Share of media outlets owned by the government	The market share of state-owned newspapers in the aggregate market share of the five largest daily newspapers (by circulation).	Djankov and others (2003)

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# What Can We Learn about Financial Access from U.S. Immigrants? The Role of Country of Origin Institutions and Immigrant Beliefs

*Una Okonkwo Osili and Anna Paulson*

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Immigrants from countries with more effective institutions are more likely than other immigrants to have a relationship with a bank and to use formal financial markets more extensively. The evidence that a country's institutional environment shapes beliefs—and by extension the use of financial services—provides support for policies that focus on institutional reforms in promoting financial access. After holding wealth, education, and other factors constant, the impact of institutional quality in the country of origin affects the financial market participation of all immigrant groups except those who have lived in the United States for more than 28 years. These findings are robust to alternative measures of institutional effectiveness, to controlling for additional country of origin characteristics, and to various methods for addressing potential biases caused by immigrant self-selection. JEL codes: O16, J61, G11

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There is a growing interest in understanding what determines the availability and use of financial services in developing and developed countries. Even across developed countries, there is significant variation in the percentage of individuals and households that use financial services. In the United States, a significant subset of the population makes little use of even basic financial services: 10–25 percent of households have neither a savings nor a checking account,<sup>1</sup> and participation in retirement savings and stock markets is even lower (Osili and Paulson 2004). In Canada, Germany, and Sweden, the fraction

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1. The exact estimate depends on the dataset. The Survey of Consumer Finances provides estimates closer to 10 percent, while the 1996–2000 SIPP data analyzed here produces estimates closer to 25 percent.

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of people without a bank account is much lower than in the United States, closer to 3 percent (Claessens 2006). The sparse data that are available suggest that in some developing countries the norm is to be without a bank account. About 75 percent of households in Mexico lack an account, as do 90 percent of Kenyan households (Beck, Demirgüç-Kunt, and Peria 2007).

Recent survey evidence from the United States suggests that a significant fraction of households choose not to hold bank accounts because they “often are imbued with a cultural distrust of banks, and they may be concerned with privacy” (Gambrell 2003, p. 2). Survey evidence from several developing countries, including Colombia and Mexico, suggests that similar concerns play a role in low rates of formal financial market participation in developing countries as well. For example, Caskey, Duran, and Solo (2006) and Solo and Manroth (2006) report that although low rates of participation are influenced by high transaction costs, lack of assets, and geographical distance to banks, many households also have concerns about the security of holding financial assets in weak institutional environments. Because financial markets provide important tools for enhancing welfare—tools to transfer resources across time and across countries, make payments, mitigate risk, and fund investments—low rates of participation may be associated with lower welfare.

This article examines the determinants of financial market participation by immigrants in the United States. It examines the role of the environment in the country of origin and the impact of individual-level characteristics, such as wealth and education. The focus is on U.S. immigrants, in part because immigrants are a large and growing segment of the U.S. population whose rates of participation in formal financial markets are low relative to otherwise similar individuals born in the United States (Osili and Paulson 2004; Rhine and Green 2006).

Focusing on U.S. immigrants makes it possible to study the impact of placing an individual into a different formal institutional environment while holding experience with institutions fixed. One can think about the immigrant experience in the United States as an experiment in institutional reform. In the process of migrating from one country to another, individuals move from one formal institutional environment to another, but they may maintain beliefs about institutions acquired in their countries of origin. This process provides an opportunity to gain insights into the potential role of institutional reform as a tool for expanding financial access. Institutional reform may increase financial access both directly (through the expansion of banks) and indirectly (through beliefs about the trustworthiness of financial institutions).

North (1990) suggests that one can think of these beliefs as informal institutional constraints or individual beliefs that are socially transmitted over time as part of the culture of a society. He defines institutions as “formal constraints—rules that human beings devise” and “informal constraints—such as conventions and rules of behavior” (p. 4). Because all immigrants face the same set of formal rules in the United States, studying the behavior of

immigrants in the United States can isolate the impact of informal institutional constraints.<sup>2</sup> Understanding the role of informal institutional constraints helps to better understand the formation of beliefs and is crucial for assessing the likely effects of formal institutional change.

Studying immigration to the United States maintains some of the interesting diversity of a cross-country study while eliminating some confounding factors. To a first approximation, it controls for factors that affect the supply of financial services across countries. The immigrants whose behavior is studied face the same competitive environment, make decisions in the same regulatory environment, are subject to the same legal structure and infrastructure, and so on. The focus is on how the experience of country of origin characteristics manifests itself in preferences and beliefs and by extension the use of financial services.

The empirical strategy is similar to that of Fernández and Fogli (2005) and Fernández (2007), who show that country of ancestry fertility and female labor force characteristics influence the fertility and work behavior of U.S.-born children of immigrants.<sup>3</sup> Studying immigrants, rather than their children, creates some additional empirical challenges. Immigrants are not random representatives of their birth countries: most of them have chosen to come to the United States. The decision to emigrate may be influenced by unobservable individual characteristics that are correlated with the country of origin variables whose influence is being measured. Techniques employed in the authors' earlier work on stock market participation (Osili and Paulson 2008) are used to ensure that the findings are robust to this type of self-selection.

The most important innovation in this article is the focus on two fundamental aspects of financial market participation: breadth and depth. Financial breadth is equal to one if an individual has any relationship with a bank (a savings or a checking account). The measure of financial depth ranges from zero to three and captures the number of distinct functions of financial markets the individual uses: safe savings products (saving accounts or certificates of deposit); payment services (checking or money market accounts); or investment services (stock, individual retirement accounts, or Keogh accounts).<sup>4</sup> In contrast to stock market participation, these measures of financial market participation are likely to be important for a broader segment of the population and are potentially of greater relevance for policymakers. This article adds to the literature by showing that the institutional quality of the country of origin affects a broad range of financial market behavior, not just stock market participation.

2. This assumption is relaxed in the empirical work by including MSAs. The empirical strategy assumes that formal institutional constraints are the same for immigrants living in the same MSA.

3. Carroll, Rhee, and Rhee (1999) use a similar approach in their study of the cultural determinants of savings. Borjas (1987) looks at the impact of country of origin characteristics on immigrant wage assimilation.

4. Use of insurance products is not explicitly examined here. The financial depth measure is likely to capture the ability of an individual to use financial markets to smooth consumption.

It adds to the growing body of work that shows that culture and beliefs are important determinants of a variety of financial and nonfinancial behavior.

One important reason for being concerned with both the breadth and the depth of financial market participation is that better developed financial markets lead to improved conditions at the country level. According to an extensive body of literature that uses cross-country data, financial development accelerates growth, decreases poverty, and reduces inequality (see, for example, Rajan and Zingales 1998; Beck, Demirgüç-Kunt, and Levine 2004; Levine 2005).

This article is also related to a growing number of studies that show that the ability of a country's institutions to protect private property and provide incentives for investment can explain persistent disparities in financial development and economic performance across countries (see, for example, La Porta and others 1998; Levine 1998, 1999; Beck, Levine, and Loayza 2000; Açemoglu, Johnson, and Robinson 2001, 2002; Beck, Demirgüç-Kunt, and Levine 2003a, 2003b; Rajan and Zingales 2003; Rodrik, Subramanian, and Trebbi 2004).

Consistent with other studies of the determinants of financial behavior among immigrants (see, for example, Rhine and Green 2006), this article finds that wealthier and more educated immigrants are more likely to use basic banking services and have higher measures of financial depth. Hogarth, Anguelov, and Lee (2004) and Vermilyea and Wilcox (2002) find that these factors are important in explaining the financial behavior of nonimmigrants as well.

For a given level of wealth, education, and other factors, immigrants from countries with more effective institutions are more likely to have a relationship with a bank and use formal financial markets more extensively than immigrants from countries with less effective institutions. These results are robust to various ways of measuring institutional effectiveness, including other country of origin controls and a number of strategies for addressing potential bias caused by immigrant self-selection, including specifications with country fixed-effects.

Country of origin institutions affect the financial market participation of recent immigrants as well as those who have lived in the United States for up to 27 years. They influence the behavior of immigrants who arrive in the United States as children as well as those who immigrate as adults. The persistence of the effects suggests that the impact of country of origin conditions on beliefs may be more important than its impact on experience with financial institutions. One might expect the effect of limited experience with financial institutions to decay relatively quickly once immigrants arrive in the United States. In fact, institutional quality appears to persistently shape preferences and beliefs in a way that influences both the breadth and the depth of financial access.

The rest of the article is organized as follows. Section I describes the data. Section II presents the empirical findings. Section III provides some concluding comments.

## I. THE DATA

Country data from various sources are combined with individual-level data from the U.S. Census Bureau's 1996–2000 Survey of Income and Program Participation (SIPP) to create the key variables of interest. Both types of data are described in this section.

### *Country Data*

The country data include various measures of institutional quality and other important country characteristics (table 1). The measure of institutional quality is “protection from expropriation.” This variable, which comes from the International Country Risk Guide (ICRG) IRIS-3 data, evaluates the risk of “outright confiscation and forced nationalization” of property. Ratings range from 1 to 10, with lower ratings given to countries in which expropriation of private foreign investment is a “likely” event. Country observations from 1982 to 1995 are averaged to form the protection from expropriation variable used in the empirical work.<sup>5</sup> Other important country of origin variables include geography, GDP per capita, measures of infrastructure availability, an indicator of whether immigrants are likely to speak English, and specific characteristics of the banking and financial sector in the country of origin, including the number of bank branches per 100,000 people and remittance flows. (For summary statistics for each of the country variables, see tables S.1.A and S.1.B in the supplemental appendix, available at <http://wber.oxfordjournals.org/>.)

### *Individual-Level Data*

Historically high rates of immigration to the United States over the past two decades have raised the proportion of the U.S. population born abroad to at least 10 percent (Lollock 2001). The SIPP data, which include some 46,000 people, 11 percent of whom are immigrants, are designed to be representative of the U.S. population. Immigrants have experienced a wide range of country of origin environments before coming to the United States.

The sample is restricted to immigrants over 18 who live in a metropolitan statistical area (MSA). It includes 15,043 observations, with about 4 annual observations per person.<sup>6</sup>

5. Institutional quality measures are assigned to individuals born in the former Czechoslovakia, Soviet Union, or Yugoslavia in the following way: individuals who reported that they were born in Czechoslovakia, the Czech Republic, or the Slovak Republic are assigned the institutional quality measure for Czechoslovakia; individuals who reported that they were born in the Soviet Union, Armenia, Azerbaijan, Belarus, the Baltic States, Estonia, Georgia, Kazakhstan, the Kyrgyz Republic, Latvia, Lithuania, Moldova, the Russian Federation, Tajikistan, Turkmenistan, Ukraine, or Uzbekistan are assigned the institutional quality measure for the Soviet Union; and individuals who reported that they were born in Yugoslavia, Bosnia and Herzegovina, Croatia, Macedonia, Montenegro, Slovenia, or Serbia are assigned the institutional quality measure for Yugoslavia.

6. Attention is restricted to the four annual survey waves for which wealth data are available. Other SIPP data are collected quarterly.

TABLE 1. Definitions and Sources of Country-Level Variables

Variable	Definition	Source
Protection from expropriation of private investment	Risk of outright confiscation and forced nationalization of property. Lower ratings are given to countries in which expropriation of private foreign investment is likely. Variable is average of annual country observations 1982–95	International Country Risk Guide (2008)
Average per capita GDP	Average real per capita GDP 1982–1995, in 1995 dollars	World Bank, World Development Indicators Database (1982–95)
English speaking	Equal to one if English is one of country's official languages and at least half of immigrants from the country surveyed in the 1980 U.S. Census report not speaking a language other than English at home	Bleakley and Chin (2004)
Remittances per capita as a percent of GDP	Total worker remittances received in a given country in a given year divided by the country's total population, divided by the country's GDP (in 1995 dollars) for a given year. Variable is average of annual country observations 1982–95	World Bank, World Development Indicators Database (1982–95)
Banking branch penetration	Number of bank branches per 100,000 people in the country, based on information from a regulatory survey	Beck, Demirgüç-Kunt, and Peria (2007)
Banking freedom	Average absence of government interference in banking system during 1995–99. Indicator is based on five questions: Does the government own banks? Can foreign banks open branches and subsidiaries? Does the government influence credit allocation? Are banks free to operate without government regulations such as deposit insurance? Are banks free to offer all types of financial services, including buying and selling real estate, securities, and insurance policies?	Beck, Demirgüç-Kunt, and Maksimovic (2004)
Internet use	Average number of Internet users (defined as people with access to the World Wide Web) per 1,000 people during 1982–95	World Bank, World Development Indicators Database (1982–95)

As a group, immigrants are younger than people born in the United States (table 2). They are more likely to have more children and to be married, nonwhite, and unemployed or economically inactive. Immigrants also tend to be less educated than the native born: slightly less than 36 percent of the

TABLE 2. Characteristics of Individuals Born in the United States and U.S. Immigrants

Characteristic	Native born	Immigrant
Age	46.47 (17.52)	45.22 (16.51)
Percent male	45.6	46.2
Percent married	57.4	65.6
Percent nonwhite	16.4	32.2
Percent unemployed or out of the labor force	33.8	36.7
Number of children under 18 in household	0.720 (1.090)	1.118 (1.347)
Average monthly per capita household income (\$)	2,224 (2,832)	1,640 (2,375)
Median monthly per capita household income (\$)	1,578	1,050
Average household wealth (\$)	185,754 (1,398,146)	122,685 (978,910)
25th percentile of household wealth (\$)	14,660	3,017
Median household wealth (\$)	71,123	29,001
75th percentile of household wealth (\$)	186,512	117,917
<i>Educational attainment (percent)</i>		
Less than high school	15.0	35.8
High school graduate	30.4	24.5
Some college	30.6	20.1
Bachelor's degree	15.9	12.5
Advanced degree	8.1	7.1
<i>Financial market participation</i>		
Financial breadth (percent with bank relationship)	76.3	61.0
Financial depth (mean number of types of financial relationships)	1.71 (1.02)	1.22 (1.01)
Financial depth (median number of types of financial relationships)	2.00	1.00
Percent who own stock	20.0	8.6
Percent with a checking account (interest or noninterest bearing)	63.8	47.0
Percent with a savings account	54.8	40.1
<i>Other characteristics (percent)</i>		
Self-employed	9.1	8.7
Drives own car to work	81.7	75.1
Visited doctor in past 12 months	78.8	79.3
Purchased prescription drugs for children in past 12 months	51.8	34.1
<i>Sample size</i>		
Number of individuals	31,046	5,020
Number of observations	100,839	15,043

Note: Numbers in parentheses are standard deviations. Except where otherwise noted, mean values are reported. The unit of observation is a person-wave. Sample is restricted to the four waves of the SIPP that provide wealth information and to individuals 18 and over living in MSAs for whom data on expropriation risk were available.

Source: Authors' analysis based on data from the U.S. Census Bureau's 1996–2000 SIPP.

immigrant sample never completed high school—more than twice the 15 percent of the native-born sample. However, the percentage of the adult population with advanced degrees is roughly similar among immigrants (7 percent) and the native born (8 percent).

Monthly per capita household income is significantly lower among immigrants than among the native born. In addition to having lower incomes, immigrant households also have far less accumulated wealth than households with U.S.-born heads. The median immigrant household has wealth of \$29,001; the median for households headed by U.S.-born individuals is \$71,123.

The indicators of financial access of interest here are financial breadth (as measured by checking or savings account ownership) and financial depth (the number of functions of financial markets—safe savings, payment services, investment services—an individual uses). The values for financial depth range from zero to three. Sixty-one percent of the immigrant sample and 76 percent of the native-born sample have a savings or a checking account (table 2). Forty-seven percent of immigrants and 64 percent of the native born have checking accounts. Savings account ownership has a similar pattern, with 41 percent of the immigrant sample and 55 percent of the native-born sample owning savings accounts. The median measure of financial depth is 1 for immigrants and 2 for the native born.

Nearly half of immigrants arrived in the United States within the 10 years before the start of the survey (table 3). Just under half were born in Latin America and the Caribbean, with about a quarter of the total sample coming from Mexico; about 18 percent were born in Europe or Canada. About 71 percent of immigrants were at least 21 years old at the time they immigrated.

## II. EMPIRICAL FINDINGS

Financial breadth ( $B_{isj}$ ) and depth ( $D_{isj}$ ) are estimated using the linear model

$$B_{isj} \text{ or } D_{isj} = \alpha + \beta_1 X_i + \beta_2 Z_j + \delta_s + \varepsilon_{isj}$$

where  $B_{isj}$  is the decision to have a bank account, and  $D_{isj}$  is the intensity of financial market participation, for individual  $i$  who lives in MSA  $s$  and comes from country  $j$ . Individual controls—including age, age-squared, wealth quartiles, income, labor force status, education, sex, marital status, number of children in the household, and race—are incorporated in  $X_i$ . These characteristics control directly for the demand for financial services and indirectly for the supply of financial services, to the extent that socioeconomic characteristics influence the location or advertising of financial services. A full set of MSA fixed effects is included in  $\delta_s$ ;  $Z_j$  measures the characteristics of country  $j$ ,

TABLE 3. Characteristics of Immigrants to the United States

Characteristic	Percent of all immigrants
<i>Year of arrival in the United States</i>	
Before 1964	11.5
1965–69	8.2
1970–74	10.1
1975–79	12.8
1980–84	17.9
1985–89	18.4
1990–96	21.2
<i>Age at migration</i>	
5 or younger	3.7
6–10	4.6
11–15	6.8
16–20	14.3
Over 20	70.6
<i>Region of origin</i>	
Latin America and Caribbean	44.3
Asia	30.3
Europe and Canada	18.0
South America	6.3
Africa	0.9
Australia and Oceania	0.2

*Note:* Mean values are reported. The unit of observation is a person-wave. Sample is restricted to the four waves of the SIPP that provide wealth information and to individuals 18 and older living in MSAs for whom data on expropriation risk were available.

*Source:* Authors' analysis based on data from the U.S. Census Bureau's 1996–2000 SIPP.

including institutional quality. The MSA controls hold variation in the supply of financial services constant at the MSA level.<sup>7</sup>

If individuals from countries with more effective institutions will be more likely to participate in financial markets, then this will manifest itself in an estimate of  $\beta_2$  that is significant and positive. It is possible that individual characteristics, such as wealth and education, are influenced by the country of origin environment as well, so the total effect of country of origin institutions may be larger than what is captured by  $\beta_2$ . Including individual characteristics allows the direct effect of country of origin institutions on behavior to be isolated.<sup>8</sup> All of the reported standard errors are adjusted to allow for correlation across

7. One concern is that the supply of banks may vary at the neighborhood level. The estimates rely on the MSA geographical identifiers available in the public use SIPP samples. It is likely that several of the individual characteristics, such as education, income, and wealth, are also correlated with the supply of banks and other neighborhood-level characteristics.

8. Doing so addresses an important concern with some earlier cross-country studies that focused on the impact of institutions on financial development. The identification strategy used by Açemoglu, Johnson, and Robinson (2001), for example, stresses the link between institutional development and settler mortality during the colonial period, but it leaves open the possibility that the human capital of colonial settlers played a role in future economic development.

observations for immigrants that come from the same country. When the dependent variable is  $B_{isj}$  (equal to one if the immigrant has a savings or a checking account and zero otherwise), a correction is made for the heteroskedasticity that is implicit in a linear probability model.<sup>9</sup>

### *Baseline Findings*

The relation between financial market participation and institutional quality is explored using a sample that is restricted to immigrants who are at least 18 years old, live in an MSA, and come from one of the 78 countries for which institutional quality data are available.<sup>10</sup> The results indicate that institutional quality has a positive and significant effect on having a bank account (table 4, column 1). If an individual from a country with average institutions, as captured by the protection from expropriation measure, had instead come from a country that had institutions that were one standard deviation above the mean, the likelihood that he or she would have a savings or a checking account would increase by 4.7 percentage points—a 7.7 percent increase in the likelihood of having a bank account relative to the observed likelihood for immigrants of 61 percent. The same change is associated with a 10 percent increase in financial depth (table 5, column 1). This is roughly equivalent to considering what would happen if Argentina's protection from expropriation measure had been the same as Germany's between 1982 and 1995.

These baseline findings suggest that immigrants come to the United States with beliefs shaped by the effectiveness of their home-country institutions. The ability of home-country institutions to protect investment and provide incentives for investment has a significant effect on immigrant behavior in the United States over and above the impact of individual characteristics such as wealth, income, and education. These results were replicated using other measures of institutional quality, with largely the same conclusions.<sup>11</sup>

### *Additional Country Controls*

How robust are these findings? Important country of origin characteristics that may be correlated with institutional quality may have been omitted from the baseline results. The impact of adding additional country characteristics is shown in columns 2–7 of tables 4 and 5.<sup>12</sup>

9. A linear probability model is used because it is computationally attractive given the large number of fixed effects, because it is consistent under weak assumptions, and because the coefficient estimates are easy to interpret. In particular, the coefficients on interaction terms are straightforward to interpret (see Ai and Norton 2003). Nonlinear estimation methods, such as probit or logit, generate similar results.

10. See table S.2 in the supplemental appendix for the impact of age, age-squared, wealth quartiles, education, and other explanatory variables on financial market participation.

11. See tables S.3A and S.3B in the supplemental appendix for these estimates.

12. The issue of omitted country characteristics is also addressed in specifications that include country fixed effects (see table 6).

TABLE 4. Effect of Institutional Quality on Probability of Having a Bank Relationship

Explanatory variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Protection from expropriation	0.027*** (0.005)	0.017*** (0.004)	0.020*** (0.008)	0.019** (0.008)	0.017** (0.008)	0.040*** (0.012)	0.038*** (0.012)
Average per capita GDP* 1,000,000			2.490** (1.180)	2.470** (1.150)	1.560 (1.12)	-5.330 (3.24)	10.0** (4.43)
English speaking				0.024 (0.018)	0.010 (0.015)	-0.073 (0.049)	-0.065 (0.47)
Remittances per capita					-0.335 (0.205)	-0.899** (0.412)	-0.963*** (0.0358)
Banking branch penetration						0.001 (0.001)	0.001 (0.001)
Bank freedom						0.065 (0.018)	0.062*** (0.018)
Internet use							0.014** (0.006)
Continent controls	No	Yes	No	No	No	No	No
Adjusted R-squared	0.2666	0.2715	0.2687	0.2688	0.2685	0.2846	0.2853
Number of observations	14,232	14,232	13,336	13,336	11,782	9,116	9,116

\*\*\*Significant at the 1 percent level; \*\*significant at the 5 percent level; \*significant at the 10 percent level.

Note: Numbers in parentheses are standard errors. All regressions include controls for age, age-squared, wealth quartiles, labor force status, income, marital status, sex, ethnicity, education, number of children, and MSA. The number of observations differs depending on the number of countries for which a particular country characteristic is available. A linear model is used and standard errors are corrected for heteroskedasticity and clustering at the country level.

Source: Authors' analysis based on data from the U.S. Census Bureau's 1996–2000 SIPP and sources cited in table 1.

TABLE 5. Effect of Institutional Quality on Depth of Financial Market Participation

Explanatory variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Protection from expropriation	0.073*** (0.013)	0.046*** (0.014)	0.046*** (0.018)	0.041** (0.019)	0.041** (0.018)	0.074*** (0.020)	0.068*** (0.020)
Average per capita GDP* 1,000,000			9.100*** (3.010)	9.030*** (3.010)	5.750** (2.780)	-3.13 (7.61)	-15.8** (7.35)
English speaking				0.077 (0.052)	0.079 (0.067)	-0.223** (0.106)	-0.204 (0.100)
Remittances per capita					-0.621 (0.372)	-1.504** (0.725)	-1.679** (0.612)
Bank branch penetration						0.001 (0.002)	0.002 (0.002)
Bank freedom						0.093** (0.040)	0.084** (0.039)
Internet use							0.039*** (0.007)
Continent controls	No	Yes	No	No	No	No	No
Adjusted R-squared	0.3999	0.4044	0.4072	0.4076	0.3943	0.4075	0.4089
Number of observations	14,232	14,232	13,336	13,336	11,782	9,116	9,116

\*\*\*Significant at the 1 percent level; \*\*significant at the 5 percent level; \*significant at the 10 percent level.

*Note:* Numbers in parentheses are standard errors. All regressions include controls for age, age-squared, wealth quartiles, labor force status, income, marital status, sex, ethnicity, education, number of children, and MSA. The number of observations differs depending on the number of countries for which a particular country characteristic is available. A linear model is used. Standard errors are corrected for heteroskedasticity and clustering at the country level.

*Source:* Authors' analysis based on data from the U.S. Census Bureau's 1996–2000 SIPP and sources cited in table 1.

Column 2 reports estimates that include continent controls in addition to protection from expropriation.<sup>13</sup> The size of the coefficient on protection from expropriation declines modestly, but otherwise the results are unchanged. This rules out the possibility that the results were driven by discrimination against individuals based on their continent of origin or that countries on the same continent tend to share institutional qualities.<sup>14</sup> Columns 3 and 4 add controls for average GDP per capita and whether the origin country is English speaking. Adding these controls does not change the strong positive correlation between coming from a country with strong institutions and participating more extensively in U.S. financial markets.

The effect of controlling for remittances to the home country is shown in column 5. If immigrants are not investing in U.S. financial markets, they may be investing at home through remittances. Including a measure of remittances received in the home country does not alter the effect of institutional quality. Immigrants from countries that receive higher per capita remittances are less likely to participate in U.S. financial markets, but the size and the significance of the remittance variable depends on the other covariates. (Ideally, one would measure the importance of remittances from the perspective of the immigrant who sends them; measures of individual remittances are not available.)

An important issue is whether the availability of home-country financial markets influences the likelihood of financial market participation among immigrants in the United States. Immigrants who come from countries in which financial markets are more developed may have more experience with banks before coming to the United States. Two explanatory variables—bank penetration and bank freedom—are added in column 6 to address this question. Bank penetration measures the number of bank branches per 100,000 residents in the country of origin.<sup>15</sup> Bank freedom measures the absence of government interference in the banking sector and is likely to be higher in countries where entry is less costly (see table 1 for definition). The freedom of the banking sector in the country of origin has a positive and significant effect on financial market participation in the United States. Bank penetration has no significant effect on financial market participation.

The remittance variable becomes statistically significant when these variables are included: as expected, immigrants from countries in which per capita remittances are higher are less likely to participate in U.S. financial markets. This result is consistent with work by Aggarwal, Demirgüç-Kunt, and Peria (2006), who find that remittances promote financial development in the receiving country.

13. The six continent groupings are Latin America and the Caribbean, Europe and Canada, Asia, Africa, South America, Australia, and Oceania.

14. Because the estimates include a control for being nonwhite, the continent controls capture differential treatment based on continent of origin, holding racial characteristics fixed.

15. Beck, Demirgüç-Kunt, and Maksimovic (2004) find that firms' access to finance is more restricted by banking industry concentration in countries in which bank freedom is lower.

The impact of home country institutions remains important even after the banking sector variables are added. The coefficient on institutional quality in the regression in which having a bank account is the dependent variable is highly significant and equal to 0.040. The availability and freedom of the banking sector is likely to be influenced, perhaps strongly, by the quality of country of origin institutions. These results were replicated using a measure of banking concentration (the percentage of banking assets held by the three largest banks), with similar results.

In column 7, a proxy for infrastructure conditions in the country of origin is added. The measure used is the number of Internet users (defined as people with access to the World Wide Web) per 1,000 people. (The specific measure does not seem to be important, as similar results are obtained for telephone use or the percentage of paved roads.) In countries in which infrastructure is weak, individuals may have little direct experience with banks and other financial institutions, because it may be costly to get to and communicate with them. These conditions appear to spill over to behavior in the United States. Immigrants from countries with more extensive infrastructure are more likely to participate in U.S. financial markets, whether financial breadth or financial depth is used as the dependent variable. The coefficient on institutional quality remains positive and strongly significant in these regressions.

Overall, the results presented in tables 4 and 5 suggest that the finding that financial market participation in the United States is influenced by the quality of institutions in the country of origin is robust to including additional attributes of the country of origin. This can be interpreted as evidence that immigrants from countries with weak institutions believe that institutions in the United States are also weak. Although other explanations are possible, many of them are less consistent with the empirical findings. For example, low rates of financial market participation among immigrants from countries with weak institutions might reflect their lack of direct experience and information about financial markets rather than a belief that institutions cannot be trusted. This seems unlikely to be the dominant explanation, however, given the positive coefficient on institutional quality in estimates that include controls for bank penetration and other characteristics of the banking and financial sector in the country of origin.

### *Immigrant Self-Selection*

Immigrants are not random representatives of their country of origin. They choose to migrate, and that decision may be influenced by characteristics that are not observable. If unobserved individual characteristics that influence the decision to migrate and the decision to participate in financial markets are correlated with institutional quality in the country of origin, the coefficient that measures the impact of institutional quality will be biased.

Borjas (1987) describes one channel through which immigrant self-selection could bias the results. In his model, the decision to migrate is a function,

among other things, of unobserved migrant ability and the distribution of income in the country of origin and the destination country. Because high-ability migrants are concerned only with the right tail of the income distribution, they tend to migrate from more equal societies to less equal ones. In contrast, low-ability migrants will move from less equal societies to more equal ones, to protect themselves against a draw from the low end of the wage distribution. Assuming that unobserved ability affects financial behavior as well as labor market outcomes, this type of selection could bias the results presented here.

Because countries with low inequality also tend to have strong institutions, the finding that financial market participation increases with institutional quality in the country of origin could be driven by ability bias. For example, immigrants from Sweden, a country with low inequality relative to the United States and high-quality institutions, are likely to be of high ability. In contrast, immigrants from Brazil, a country with high inequality and less effective institutions, will tend to have lower unobserved ability.

Other unobserved individual characteristics that may influence the decision to participate in financial markets and may also be correlated with institutional quality in the country of origin. For example, immigrants from countries with weak institutions may come from parts of the country that have fewer financial institutions. In contrast, immigrants from countries with strong institutions may come from parts of the country in which financial markets are very deep. These potential factors cannot be addressed directly, because neither individual data on the region within a country an immigrant comes from nor data on experience with financial institutions are available. To produce unbiased estimates of the effect of institutional quality in the country of origin on financial market participation in the United States, one would like to eliminate the possibility that omitted individual characteristics (such as risk aversion or prior exposure to formal financial institutions) are correlated with institutional quality in the country of origin. Unobserved individual heterogeneity need not be completely eliminated to produce unbiased estimates of the effect of institutional quality. Because the variable of interest, institutional quality, varies only at the country level, the goal is to eliminate sources of unobserved heterogeneity that are correlated with country of origin characteristics.

Ideally, one would simply include country of origin fixed effects in the baseline specification to ensure that the error term in the regression was orthogonal to all country of origin characteristics. This approach is not feasible, because the key variable of interest, institutional quality, does not vary at the country level.

A new measure of institutional quality that varies by country of origin was therefore created. This measure draws on the literature that shows that a wide range of immigrant behavior is influenced by the size of the immigrant network. Network effects have been shown to be important for employment (Munshi 2003), wage growth and human capital accumulation (Borjas 1995,

2000), and language proficiency (Chiswick and Miller 1996). Fernández and Fogli (2005) show that the impact of country of ancestry norms on fertility and women's labor force participation is amplified for the children of immigrants who reside in neighborhoods with other people from the same country of ancestry.

Following this literature, the new measure of institutional quality captures both institutional quality and the potential size of an immigrant network. The alternative measure of institutional quality varies by country of origin, which allows country of origin fixed effects to be included in the estimation and any correlation between unobserved individual attributes and country of origin to be eliminated.

Ethnic concentration is used to measure the potential size of the immigrant network for migrants from a particular country who live in a particular MSA. It is defined as the percentage of people in an MSA who come from the same country as the immigrant in question:

$$EC_{sj} = \frac{\text{Number of immigrants from country } j \text{ living in MSAs}}{\text{Total population in MSAs}}$$

Data from the U.S. Census Bureau's 1990 Integrated Public Use Microdata Series (IPUMS) (Ruggles and others 2008) were used to create this measure for each country of origin and MSA pair.

There is significant variation in ethnic concentration across MSAs for immigrants from a particular country. Mexican immigrants, for example, make up 4.2 percent of the population in Chicago but just 0.5 percent of the population of Milwaukee. The potential size of the immigrant network also varies by country of origin.<sup>16</sup> The median Cuban immigrant, for example, lives in an area in which 17 percent of the population is from Cuba; the median Mexican immigrant lives in an area in which 9 percent of the population is from Mexico. By contrast, immigrants from Vietnam and India are much less likely to cluster: Vietnamese immigrants account for only 0.7 percent of their typical neighborhood in the United States, and Indian immigrants account for just 0.3 percent. In addition to variation by country, there is also variation in the size of the potential immigrant network across MSAs for immigrants from a particular country.

The new measure of institutional quality,  $Z_j \alpha EC_{sj}$ , is equal to the interaction of institutional quality and ethnic concentration for an individual from country  $j$  who lives in MSA  $s$ . The following model is estimated:

$$B_{isj} \text{ or } F_{isj} = \alpha + \beta_1 X_i + \beta_2 Z_j \alpha EC_{sj} + \beta_3 EC_{sj} + \delta_s + \delta_j + \varepsilon_{isj}.$$

16. For information on the median ethnic concentration for immigrants from each country, see table S.4 in the supplemental appendix.

TABLE 6. Institutional Quality and Ethnic Concentration

Explanatory variable	Probability of having a bank relationship	Depth of financial market participation
Protection from expropriation*	0.827*	2.422**
ethnic concentration	(0.487)	(1.075)
Ethnic concentration	-5.734*	-18.090**
	(3.581)	(7.995)
Country controls	Yes	Yes
Adjusted R-squared	0.2754	0.4104
Number of observations	13,867	13,867

\*\*\*Significant at the 1 percent level; \*\*significant at the 5 percent level; \*significant at the 10 percent level.

*Note:* Numbers in parentheses are standard errors. All regressions include controls for age, age-squared, wealth quartiles, labor force status, income, marital status, sex, ethnicity, education, number of children, and MSA. A linear model is used. Standard errors are corrected for heteroskedasticity and clustering at the individual level.

*Source:* Authors' analysis based on data from the U.S. Census Bureau's 1996–2000 SIPP and sources cited in table 1.

A full set of country of origin controls is included in  $\delta_j$ . All of the other variables are defined above. One would expect  $\beta_2$  to be positive and the effect of high-quality institutions to be magnified for immigrants who live in MSAs with large percentages of other immigrants from the same country, who have experienced the same institutions. The ethnic concentration variable on its own,  $EC_{sj}$ , helps control for the availability of informal investments that might substitute for formal financial services. This implies that the sign of  $\beta_3$  will be negative and that individuals who reside in MSAs with a large fraction of immigrants from the same country of origin will be less likely to participate in formal financial markets.

Including MSA fixed effects in all of the estimates rules out another potential source of bias in the new institutional quality measure.<sup>17</sup> As location choice is nonrandom, immigrants who choose to live in an MSA with a large fraction of immigrants from the same country of origin may be systematically different along unobservable dimensions from immigrants who choose to live in an MSA with very few immigrants from their country of origin. Including MSA fixed effects ensures that the coefficient on protection from expropriation interacted with ethnic concentration will not be biased by these unobservable characteristics.

The estimates using the new institutional quality measure and country of origin fixed effects show that the coefficient on institutional quality interacted with ethnic concentration is positive and significant for both breadth and depth (table 6).

17. Because  $EC_{sj}$  varies by country of origin for a given MSA, both country and MSA fixed effects can be included in the regressions.

For the median immigrant who lives in an MSA in which 0.78 percent of the population comes from the same country, the likelihood of having a bank account would increase 1.1 percentage points and the individual would use 0.03 more financial market functions if institutional quality were one standard deviation higher from 1982 to 1995. In the baseline estimates without country of origin fixed effects, the same change in institutional quality was estimated to be 4.7 percentage points for financial breadth. This suggests that immigrant self-selection that is correlated with institutional quality is substantial and may account for nearly three-quarters of the size of the estimated effect in the baseline specification.

These findings also indicate that the impact of coming from a country with weak institutions is reinforced when individuals from countries with weak institutions live near one another. For example, ethnic concentration is roughly twice the median for Filipino immigrants and about half the median for Portuguese immigrants. A one standard deviation improvement in institutions in the Philippines is predicted to raise the probability that Filipinos have a bank account by 2.6 percentage points and to increase financial depth by 0.08. Among Portuguese immigrants, the same improvement in institutional quality would increase bank account ownership by 0.52 percentage points and financial depth by 0.02. The finding that the effect of institutional quality varies with the size of the potential immigrant network is consistent with work by Madrian and Shea (2000); Duflo and Saez (2002); and Hong, Kubik, and Stein (2004), who show that social interactions have important effects on financial decisions.

In addition to addressing an important econometric issue, the estimates that include institutional quality interacted with ethnic concentration may shed light on a substantive issue. North (1993) defines institutions as a trinity consisting of the formal rules of the game, informal institutional constraints, and the enforcement of formal and informal constraints. One potential role of neighborhoods with large populations of immigrants from a single country is the enforcement of country of origin norms and customs (see, for example, Kandori 1992). When immigrants live in a place in which country of origin institutional constraints are more likely to be enforced, these constraints should matter more.

Another possibility is that immigrants from countries with weak institutions who also lack experience with financial institutions seek out locations in the United States where their immigrant network is particularly large because they rely on the immigrant network for informal substitutes to formal finance. It is also possible that groups of immigrants from countries with weak institutions who are particularly suspicious of formal financial institutions decide to locate in areas in which their immigrant network is larger because the network offers informal substitutes for formal finance. These explanations of the findings are broadly consistent: all rely on the institutional environment in the country of origin shaping immigrant beliefs in a way that influences financial choices and potentially decisions about where to locate in the United States.

### *Persistence of Institutions*

How persistent are the effects of country of origin institutions? The effect of institutional quality in the country of origin on financial market participation in the United States is examined for subsets of immigrants based on the number of years they have lived in the United States (table 7)

Columns 2–6 divide immigrants into five subsamples based on how long they have been living in the United States. Two estimates are produced for each subsample: one that includes controls for how old the immigrant was when he or she arrived in the United States and one that does not. The effects of informal institutional constraints are very persistent. The effect of protection from expropriation is positive and significant for every subsample except the subsample of immigrants who have been in the United States for more than 28 years.

The persistent impact of country of origin institutions suggests that lack of experience with financial institutions before migration is unlikely to be the major mechanism by which institutions influence individual behavior. If lack of experience with institutions because of restricted supply conditions in the country of origin were the primary mechanism through which institutions influenced individual behavior, the effect would be likely to decay relatively quickly with time spent in the United States. The long-lasting effect of country of origin institutions is akin to the finding that individuals who lived through the Great Depression have persistently higher savings rates (see Meredith and Schewe 1994).

### *Intergenerational Transmission of Informal Institutional Constraints*

The robustness of the findings can also be examined by studying the mechanism through which institutions influence behavior and by determining whether institutional beliefs and attitudes are passed on across generations. The SIPP data provide information on region or country of ancestry for individuals born in the United States. These data can be used to determine the effect of institutional quality in the home country (or country of ancestry) on having a bank account and on financial depth (table 8).

The results indicate a positive and significant effect of institutional quality on financial market participation for immigrants but not for their descendants: among individuals born in the United States who trace their ancestry to one of the same countries, institutional quality in the country of ancestry has no effect on financial market participation. The influence of institutional environment in the country of origin thus does not appear to be passed on to future generations.

### *Additional Robustness Checks*

The effect of institutions in the country of origin is present even in immigrants who were younger than 16 when they immigrated (that is, before many of

TABLE 7. Persistence of Effect of Institutional Quality in Home Country on Financial Market Participation, by Years in the United States

Item	Years in the United States					
	All	1–7	8–12	13–17	18–27	28+
<i>Probability of bank relationship</i>						
No age at arrival controls						
Protection from expropriation	0.027*** (0.005)	0.022** (0.011)	0.029** (0.011)	0.023*** (0.008)	0.027*** (0.009)	0.012 (0.011)
Adjusted R-squared	0.2666	0.3653	0.3168	0.3033	0.2653	0.2369
Age at arrival controls						
Protection from expropriation	0.027*** (0.005)	0.022** (0.011)	0.027** (0.011)	0.022*** (0.008)	0.027*** (0.009)	0.010 (0.011)
Adjusted R-squared	0.2673	0.3679	0.3191	0.3046	0.2656	0.2427
<i>Depth of financial market participation</i>						
No age at arrival controls						
Protection from expropriation	0.071*** (0.012)	0.052** (0.023)	0.078*** (0.024)	0.081*** (0.019)	0.083*** (0.020)	0.050* (0.029)
Adjusted R-squared	0.3969	0.4293	0.4593	0.4369	0.4284	0.3967
Age at arrival controls						
Protection from expropriation	0.069*** (0.012)	0.052** (0.022)	0.075*** (0.023)	0.081*** (0.020)	0.083*** (0.020)	0.039 (0.028)
Adjusted R-squared	0.3978	0.4312	0.4630	0.4364	0.4283	0.4012
Number of observations	14,232	2,619	2,192	2,145	2,750	2,955

\*\*\*Significant at the 1 percent level; \*\*significant at the 5 percent level; \*significant at the 10 percent level.

Note: Numbers in parentheses are standard errors. All regressions include controls for age, age-squared, wealth quartiles, labor force status, income, marital status, sex, ethnicity, education, number of children, and MSA. A linear model is used. Standard errors are corrected for heteroskedasticity and clustering at the country level.

Source: Authors' analysis based on data from the U.S. Census Bureau's 1996–2000 SIPP and sources cited in table 1.

TABLE 8. Intergenerational Transmission of Institutional Lessons: The Effect of Institutional Quality on Financial Market Participation, Selected Native Born and Immigrants

Measure	Selected native born	Immigrant
<i>Probability of bank relationship</i>		
Protection from expropriation	-0.0001 (0.012)	0.041*** (0.010)
Adjusted R-squared	0.2226	0.2964
<i>Depth of financial market participation</i>		
Protection from expropriation	0.039 (0.038)	0.127*** (0.029)
Adjusted R-squared	0.3666	0.4300
Number of observations	44,181	7,040

\*\*\*Significant at the 1 percent level; \*\*significant at the 5 percent level; \*significant at the 10 percent level.

*Note:* Numbers in parentheses are standard errors. All regressions include controls for age, age-squared, wealth quartiles, labor force status, income, marital status, sex, ethnicity, education, number of children, and MSA. A linear model is used. Standard errors are corrected for heteroskedasticity and clustering at the country level. Selected native born includes U.S.-born individuals who identified their ancestral country as Canada, Cuba, the Dominican Republic, France, Germany, Hungary, Ireland, Italy, Mexico, the Netherlands, Poland, Russian Federation, or the United Kingdom. The immigrant sample includes individuals born in the same countries.

*Source:* Authors' analysis based on data from the U.S. Census Bureau's 1996–2000 SIPP and sources cited in table 1.

them would have been likely to have had much direct experience with institutions other than school). This finding suggests that families and possibly the education system, not just direct experience, play important roles in shaping an individual's beliefs about the trustworthiness of institutions (see table S.5 in the supplemental appendix).

Institutional quality is particularly important in explaining financial behavior when the institutional confidence required for an investment is especially high. Institutions have a greater effect on owning stock than on having a savings account, for example. Institutions have no effect on nonfinancial behavior, such as driving a car to work or visiting a doctor. The finding that institutions matter when they would be expected to and do not matter when they would not be expected to suggests that institutional quality is not a proxy for some other country of origin characteristic—national attitudes regarding self-reliance or altruism, for example—that explains all sorts of behavior (see table S.6).

Institutional quality affects groups of immigrants differently (see table S.7). Although institutional quality has a significant effect on financial behavior for both immigrants with high levels of education and those with low levels, it has a larger effect on the behavior of immigrants with less schooling. Restricting the sample to naturalized U.S. citizens reveals that financial breadth and financial depth are significantly positively correlated with home-country institutional effectiveness. A quarter of the immigrants were born in Mexico; eliminating

Mexican immigrants from the sample shows that the results are not driven by this large number of immigrants who share the same institutional environment.

Interacting the institutional quality measure with wealth quartiles and income deciles reveals that institutional quality is strongly associated with greater financial market participation for all wealth quartiles and that the size of the effect is not statistically different across wealth quartiles. For income, the effect of institutional quality is positive and statistically significant for the bottom four quintiles. For households in the top 20 percent of the income distribution, institutional quality has no statistically significant effect on financial breadth or depth.

### III. CONCLUSIONS

Immigrants from countries with institutions that more effectively protect private property and provide incentives for investment are more likely to have a bank account in the United States and to participate more extensively in U.S. financial markets than immigrants from countries with institutions that do so less effectively. These findings are robust to alternative measures of institutional effectiveness and to various methods of controlling for immigrant self-selection, including specifications with country fixed effects.

What do these findings reveal about the likely results of efforts to increase financial access in developing countries? First, institutional reform is a very important tool for expanding financial access. It is likely to increase financial access both directly (through the expansion of banks) and indirectly (through beliefs about the trustworthiness of financial institutions). Second, institutions matter even after controlling for wealth, income, and education. This suggests that limited use of financial services is not simply a problem of poverty (see Claessens 2006). While poverty reduction is likely to increase financial market participation, institutional reform has an important role to play as well.

One can think about the immigrant experience in the United States as an experiment in institutional reform. In some sense, this experiment corresponds to a best-case scenario for institutional reform: the change in the institutional environment is credible and multifaceted, affecting fiscal, monetary, and trade policy as well as the judicial and political system. In addition, through the decision to migrate, most of the people in the sample sought out institutional change and were motivated to succeed economically. Because mistrust of banks is deeply rooted in informal institutional constraints and slow to change, even in this environment institutions in the country of origin influence the behavior of immigrants in the United States for decades.

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## SUPPLEMENTARY MATERIAL

Supplementary Material is available at *The World Bank Economic Review* online.

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# Experimental Evidence on Returns to Capital and Access to Finance in Mexico

*David McKenzie and Christopher Woodruff*

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A strong theoretical argument for focusing on access to finance is that financial market imperfections can result in large inefficiencies, as firms with productive investment opportunities underinvest. Lack of access to finance is a frequent complaint of microenterprises, which account for a large share of employment in developing countries. However, assessing the extent to which a lack of capital affects their business profits is complicated by the fact that business investment is likely to be correlated with a host of unmeasured characteristics of the owner and firm, such as entrepreneurial ability and demand shocks. In a randomized experiment that gave cash and in-kind grants to small retail firms, providing an exogenous shock to capital, the shock generated large increases in profits, with the effects concentrated among firms that were more financially constrained. The estimated return to capital was at least 20–33 percent a month—three to five times higher than market interest rates. JEL codes: O17, O16, C93

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Lively microenterprise sectors are a dominant feature in urban areas of low- and middle-income countries, where as much as one-third of the labor force is self-employed. A plurality of owners of microenterprises is involved in retail trade (street vendors and owners of small shops and restaurants). These vendors earn their living using their own labor and small amounts of capital. They generally lack access to loans from formal financial institutions, relying on their own savings and perhaps informal loans from family members or friends. Surveys indicate that the lack of access to finance is one of their most often mentioned complaints.

How much does the lack of capital affect enterprise earnings? At least one study of Mexico suggests that the effect is considerable. McKenzie and

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Woodruff (2006) use data from the Mexican National Survey of Microenterprises (ENAMIN), a cross-section conducted every two years during 1992–98, to estimate returns to capital. They find returns in the range of 10–15 percent a month for the smallest firms, those with capital stocks of less than \$500. For each additional \$100 invested in the enterprise, earnings rise \$10–\$15 a month. Although provocative, the returns estimated by McKenzie and Woodruff are subject to several concerns. A primary concern is whether capital investment is correlated with unmeasured ability, resulting in conflation of returns to capital with returns to ability. McKenzie and Woodruff address this issue with several measures of ability, but each is imperfect. The use of standard panel data would not resolve all of the issues, because changes in capital stock between rounds of a panel would be endogenous to unmeasured shocks to demand for a firm's output, among other factors.

To deal with these concerns, the authors designed a randomized experiment to generate data that yield a consistent measure of returns to capital in microenterprises. Data were collected from a panel of microenterprises in the city of León, Guanajuato, in Mexico, over five quarters. After the first through fourth rounds of the survey, treatments were administered in the form of either cash or equipment to randomly selected enterprises in the sample. The treatments generated positive shocks to capital stock. These shocks were random and thus uncorrelated with either the ability of the enterprise owner or the prospects for the business.

A 1,500 peso (\$140) treatment is estimated to increase monthly profits by at least 292–487 pesos, a marginal return to capital of 20–33 percent. The estimates are robust to controls for possible treatment spillovers and attrition. These returns are at the upper end of the range estimated by McKenzie and Woodruff (2006) using nonexperimental methods. The treatment effect is then interacted with various measures of financial constraints and access to finance. The return is much higher (70–79 percent) for firms that report being financially constrained and much lower for firms that report that lack of finance is not a constraint. Indeed, the possibility of no return for non-credit-constrained firms cannot be rejected. Finance is reported to be less of a constraint for firms that are formal, have more educated owners, and have owners whose fathers owned a business.

An unbiased estimate of returns to capital has important policy implications in several areas. First, the returns from investment provide an upper bound of interest rates that borrowers are willing to pay to microlending organizations. Higher returns imply a higher likelihood of developing financially sustainable microlenders. There is considerable debate about the sensitivity of microfinance demand to higher interest rates (Morduch 2000; Karlan and Zinman 2008a). Mexico has a very underdeveloped microlending sector relative to other low- and middle income countries. High returns may suggest the scope for more lending.

Second, if returns are below some investment threshold, these low returns may act as an entry barrier, preventing high-ability entrepreneurs without

access to capital from entering. If returns to capital are high at very low levels of investment, capital-constrained entrepreneurs should be able to enter and grow to a desired size by reinvesting profits earned in the enterprise. In this case, capital constraints will have short-term costs but fewer long-term effects on outcomes. High returns at low to very low capital stock levels suggest that credit constraints will not lead to poverty traps.

The recent literature generally finds high rates of return to capital in small-scale enterprises. With one exception, it uses nonexperimental approaches to estimate the return to capital. Banerjee and Duflo (2004) use changes in laws forcing Indian banks to make preferential loans to certain groups of firms (considerably larger than those studied here) to identify changes in access to finance among the firms. They conclude that returns to capital are 74–100 percent a year. Udry and Anagol (2006) estimate annual returns to capital among small-scale agricultural producers on median-sized plots in Ghana at 50 percent for traditional crops and 250 percent for nontraditional crops. They also calculate the effective discount rates from the market for used taxi parts. Using data on prices and useful lives of used taxi parts, they estimate the annual discount rate among taxi drivers to be 60 percent, suggesting that the shadow value of capital among taxi drivers is at least this high. Kremer and others (2007) creatively use the data on stock-outs and discounts for bulk purchases to estimate annual returns of at least 113 percent for rural retail shops in Kenya.

Randomized experiments have become increasingly popular in development economics as a way to overcome many of the identification concerns that can arise with nonexperimental approaches. Many of the earliest applications were in education and health (see, for example, Kremer 2003). Several recent articles use randomized experiments to examine some aspects of access to finance, including the impact of consumer credit (Karlan and Zinman 2008b) and the comparative roles of joint and individual liability in microfinance groups (Giné and Karlan 2006). The only other study the authors are aware of that takes an experimental approach to relaxing capital constraints on firms is work on Sri Lanka by De Mel and others (2008). Using a similar experimental design, that study find returns for similar size enterprises in both the retail and manufacturing sectors in the range of 5–7 percent a month, several times higher than market interest rates, with lower returns for females than males.

This article focuses on male-owned firms in the retail trade industry. It shows that the high returns for this group found in Sri Lanka generalize to a very different country context. The article also breaks out returns for firms with and without prior access to finance.

The next section describes the sample selection, the relevant portion of the survey instrument, and the data. Section II describes the experimental intervention. Section III presents the estimation of the treatment effects, and Section IV looks at the effect of access to finance on returns. The last section discusses the results and provides some concluding remarks.

## I. THE SAMPLE AND THE DATA

Data come from a panel survey of microenterprises in the city of León, in the state of Guanajuato, Mexico. León is the fifth largest city in Mexico, with a metropolitan area population of about 1.4 million. The city is the center of Mexico's shoe and leather industries and home to a vibrant microenterprise sector covering the usual range of activities found in the developing world.

The initial survey was conducted in November 2005, reflecting data from October 2005. Subsequent surveys were administered quarterly, with the fifth and last survey conducted in November 2006. The first round of the panel includes 207 firms.<sup>1</sup> Of these firms, 182 are resurveyed in the first follow-up (February 2006) and 137 firms in the fifth round. Profits are reported by 114 firms in all five rounds of the survey and by 161 firms in at least three rounds. Attrition is thus of some concern in analyzing the results of the survey, as discussed below.

### *The Sample*

The authors set out to select a sample of enterprises with less than 10,000 pesos (about \$1,000) in capital stock excluding land and buildings. An upper limit was placed on capital stocks because the results of McKenzie and Woodruff (2006) suggest that returns are highest at very low levels of capital. Doing so eliminates firms that have managed to grow above a certain size, but the vast majority of firms starting small in the retail sector never grow large. Moreover, the sample also includes young firms, which might grow above this threshold in the future.

The project budget was sufficient to follow a sample of about 200 firms for five quarters. Cross-sectional data on similar enterprises from the ENAMIN indicate that variances in the reported data on key statistics such as profits and income are very high. To reduce the expected variance and increase the expected power of the estimates based on the data, the authors limited the sample to enterprises engaged in retail trade and owned by men ages 22–55. Only owners working at least 35 hours a week were included in the baseline period.

The retail trade sector covers a wide range of typical small-scale businesses found in many developing economies. Examples include sellers of groceries, flowers, DVDs, shoes, small toys, batteries, balloons, tacos, newspapers, bread, fruit, watches, seafood, beer, wallets, leather bags, handicrafts, perfume and cosmetics, corn holders, chilies, juices, books, and clothing.

The sample frame is based on the 10 percent public use sample of the 2000 population census for León. These data indicate that 79 percent of the full-time self-employed are male and that 80 percent of the male full-time self-employed

1. Initially, the first round included 220 firms. Thirteen firms that did not meet the original sample criteria were eliminated before the second round of the survey began.

are ages 22–55. Wholesale and retail trade is the most common industry among men in the age group, accounting for more than 29 percent of full-time self-employment. The next most common industries are manufacturing (26 percent), personal services (12 percent), and construction (9 percent).

The data were examined at the level of the smallest geographic unit available in the public sample, the primary sampling unit (*unidad primaria de muestreo*, or UPM). An average UPM in León contains about 17,000 people, about 3,400 of them men ages 22–55. For each UPM, the average education level, the percentage self-employed in the retail sector, and the percentage of households with a male household head present were calculated. These data were used to select 20 UPMs with high rates of retail self-employment and modest average levels of education.

Attention was restricted to UPMs satisfying these criteria, for two reasons. The first was cost and logistics. The survey randomly selected blocks within these UPMs and administered a short screening survey to both households and small enterprises. Restricting the survey to UPMs with high incidences of self-employment ensured that the screening survey would capture enough firms with characteristics fitting the criteria and that the firms would not be so scattered throughout the city that it would be difficult to administer the experiment and follow-up surveys. The screening survey identified enterprises owned by men ages 22–55 in the retail sector operating without paid employees. Enterprises with paid employees are likely to exceed the upper limit of 10,000 pesos of capital stock, so the lack of paid employees was used as an initial screen for capital stock. The screening survey also asked respondents the value of their capital stock excluding land and buildings, measured at replacement cost. The second reason for focusing on UPMs with a high incidence of self-employment and modest average levels of education is that these are potentially the areas in which microfinance or other access to finance interventions would be targeted (that is, areas in which many low-income households depend on self-employment).<sup>2</sup>

The survey data are not representative of the full sample of own-account workers (table 1). The mean level of monthly income in the sample (2,547 pesos) is less than half that of own-account workers in the census (5,671 pesos). The difference in median income is smaller (2,213 compared with 4,286 pesos a month) but still considerable. The comparison is not altered when the census sample is limited to own-account workers in the retail sector. Almost 12,000 prime-age men in León—about 30 percent all male own-account workers—are own-account workers in the retail trade sector.<sup>3</sup>

2. Had UPMs been chosen randomly, it is possible that by pure chance all the microenterprises in the survey could have come from relatively wealthy areas, where few other microenterprises operate.

3. The factor weights included in the census suggests that there are almost 30,500 own-account workers in the city's retail sector, including both males and females of all ages. The treated sample represents too small a number to be concerned about the general equilibrium effects of the treatments.

TABLE 1. Income, Education, and Age Distribution of the Sample and the General Population in León, Guanajuato

Source and characteristics	Distribution of income data (pesos per month)						Mean (years)
	10th percentile	25th percentile	Median	75th percentile	90th percentile	Mean	
<i>Survey</i>							
Nominal pesos	965	1,800	2,800	4,000	6,150	3,222	
2,000 pesos	763	1,423	2,213	3,162	4,862	2,547	
<i>Census</i>							
All working men ages 22–55	1,714	2,143	3,000	4,286	8,000	4,580	
Men ages 22–55 working on own account	1,714	2,357	4,281	6,429	12,000	5,671	
Men ages 22–55 working on own account in retail	1,714	2,143	4,286	6,429	12,857	6,345	
Men ages 22–55 working on own account, truncated at lower 67 percent of population	1,286	2,143	2,571	4,000	4,286	2,809	
Source and characteristics	Distribution of education						Mean (years)
	<3 years (percent)	4–6 years (percent)	7–9 years (percent)	10–12 years (percent)	13–16 years (percent)	17 years (percent)	
<i>Survey</i>							
Sample	22	38	13	20	6	1	6.8
<i>Census</i>							
All working men ages 22–55	16	31	27	13	8	5	7.6
Men ages 22–55 working on own account	17	30	24	14	8	7	7.7
Men ages 22–55 working on own account in retail	15	28	29	18	7	3	7.6
Men ages 22–55 working on own account, truncated at lower 67 percent of population	23	36	24	12	3	2	6.7

	Age of owner (years)					
	10th percentile	25th percentile	Median	75th percentile	90th percentile	Mean
<i>Survey</i>						
Sample	25	29	37	44	50	37
<i>Census</i>						
All working men ages 22–55	24	27	34	42	49	35
Men ages 22–55 working on own account	26	31	38	45	51	38
Men ages 22–55 working on own account in retail	26	31	38	45	51	38
Men ages 22–55 working on own account, truncated at lower 67 percent of population	26	30	38	45	51	38

*Note:* Data are for all firms in the baseline sample. The distributions of income, education, and age are very similar for the sample of 114 firms reporting profit in all five rounds of the survey.

*Source:* Authors' analysis based on 2000 Mexican population census and 2005/06 sample survey in León, Mexico.

These findings are not surprising given the upper limit placed on the sample of 10,000 pesos in non-real estate capital. The upper tail of the size of enterprises is excluded from the sample. When the upper third of the income distribution is eliminated from the census sample, the distribution is quite close to that of the sample: mean income from the truncated census sample is 2,809 pesos a month (about 10 percent higher than the mean in the sample), and the difference in medians is about 16 percent. The differences are greatest in the lower tail of the distribution.<sup>4</sup> Thus, the sample appears to represent the lower two-thirds of the income distribution of own-account workers in León.

Years of schooling of the sample also differ from those for León as a whole, with owners in the sample having less schooling (6.8 years) than those in the census (7.7 years). The differences are especially notable at the lowest schooling levels. In the sample, 22 percent of owners have no more than three years of schooling, and 38 percent have just four to six years. In León, among self-employed men of same age, 17 percent have no more than three years of schooling, and 30 percent have just four to six years of schooling. Once the top third of income earners is eliminated from the census, the distribution of education matches that in the sample remarkably well: 23 percent of the self-employed in the truncated census sample have no more than three years of schooling, and 36 percent have four to six years. The sample has a somewhat lower proportion with lower secondary schooling (13 percent compared with 24 percent in the census) and a higher proportion with upper secondary schooling (20 percent compared with 12 percent in the census).

The distribution of age is similar in the sample and the census. It is little affected by truncation of the census sample.

Overall, the data suggest that the sample accurately represents the bottom two-thirds of the sample of self-employed men in León, where own-account workers represent about 20 percent of the 22- to 55-year-old male workforce. Hence, the sample represents a sizable portion (about 14 percent) of the male labor force.

Data from the nationally representative ENAMIN can be used to determine how the capital stock of firms in our sample compares with those of other retail firms. The mean capital stock of the sample firms was 5,600 pesos at the time of the baseline survey, and the median was 5,100 pesos. The 1998 ENAMIN contains 609 own-account workers in the retail trade sector. Their enterprises have a median capital stock of 5,920 pesos and a mean capital stock of just over 18,000 pesos. Adjusting the data for inflation between 1998 and 2005, the median enterprise in the sample has a capital stock that is about 66 percent of the average own-account enterprise. As with the population

4. About one-sixth of own-account workers in the census report monthly incomes of 4,286 pesos (1,000 pesos per week). The mean income of the census sample truncated just below this level (at the 50th percentile) is 2,342 pesos; the mean of the census sample truncated just above this level is 2,797 pesos.

census and income, truncating the ENAMIN sample at the 67th percentile results in a distribution of enterprise capital stocks that is reasonably close to the distribution in the sample. The ENAMIN sample firms are smaller in the lower tail (700 pesos compared with 1,742 pesos, deflated to 1998 pesos, at the 25th percentile, for example) and larger in the upper tail (8,000 pesos compared with 6,511 pesos, deflated to 1998 pesos, at the 75th percentile). On average, however, enterprises in the truncated ENAMIN sample are only 12 percent larger than those in the sample.

### *The Data*

The baseline survey was carried out in November 2005. The survey instrument was modeled after the ENAMIN survey. The first round gathered detailed information on the capital invested in the enterprise, separated by tools, machinery and equipment, vehicles, real estate and buildings, and inventories and finished and unfinished goods. It also gathered operational data on the firm (revenues, expenses, and profits) for the preceding month, as well as personal information about the owner. Each subsequent survey asked firms about the changes in capital stock (the purchase of new assets or the sale of the existing assets) and operational data for another month of the survey.

The main outcome of interest is firm profits. Profits are measured by responses to the question: "What was the total income the business earned during the month of March after paying all expenses including the wages of employees, but not including any income you paid yourself. That is, what were the profits of your business during March?" This wording is the same as in the ENAMIN survey. De Mel and others (2009) show that directly asking for profits gives a more reliable measure than taking revenue minus expenses, with the mismatch in timing between when expenses are incurred and the revenues from these expenses are realized accounting for much of the difference between the two measures. Nominal profits were then deflated into real (October 2005) profits using the consumer price index for León.<sup>5</sup>

The average enterprise has been operating for just over five years. About 20 percent of the enterprises were started within a year of the baseline survey, and almost 20 percent are at least 10 years old. Sales average 5,700 pesos a month and profits 3,486 pesos a month. The median levels of sales (5,000 pesos a month) and profits (3,000 pesos a month) are similar. Owners were asked about profits before accounting for any compensation for their own time, so the profit levels should be viewed as including the opportunity cost of the time spent in the enterprise by the owner. As a result, profits are never reported as being negative.

5. <http://www.banxico.org.mx/polmoneinflacion/estadisticas/indicesPrecios/indicesPreciosConsumidor.html> [accessed March 17, 2008].

## II. THE EXPERIMENTAL INTERVENTION

This section describes the experimental intervention, the staggering of treatment, attrition and noncompliance, and the volatility of monthly profit data reported by firms.

### *The Randomized Experiment*

The randomized experiment aimed to provide exogenous shocks to the capital stock of microenterprises. This was accomplished by giving grants to a randomly selected subset of firms in the sample. Grants were used instead of loans, because the aim is to determine the marginal return to capital for the average small microenterprise, not just the microenterprise that would take up a loan with particular terms if offered such a loan. The likelihood that a microenterprise owner would take a loan would be affected by factors such as credit constraints, risk aversion, ability, beliefs about future productivity, and experiences with debt. Providing grants reveals whether greater access to capital has the potential to provide high returns to firms more generally. This can be of direct interest to governments contemplating grants for poverty alleviation, and it can show whether firms not currently borrowing have the potential to earn sufficient returns to repay loans at relatively high interest rates.

Before the first round of the survey, firms were told that the only compensation that they would receive for participating was a chance of receiving either cash or capital through prizes to be given after each survey round.<sup>6</sup> The prize was a grant of 1,500 pesos (about \$140). After the first round of the survey, a single draw from a computerized random number generator was used to randomly assign firms to treatment and control groups.<sup>7</sup> Among the firms assigned to treatment status, the random draw also determined the round in which they would be treated and whether they would receive their grant as cash or capital for their enterprise. The results of the initial random draw were not revealed to either the survey company or the firms in the sample. After each round, the survey company was given a list of firms to which to distribute the grants. Each firm could receive a prize at most once, although this was not made explicit to the firms.

Half of the grants were provided in cash and half as equipment or inventories. This replicates the grant process used in Sri Lanka by De Mel and

6. It does not seem plausible that forward-looking firms would have changed their behavior in expectation of compensation, as they were not told the odds of a prize and had no prior relationship with the survey firm and thus would be somewhat uncertain about whether the prizes would really be given out. In addition, the gradual roll-out of the treatment meant that untreated firms had no reason to believe the probability of treatment was so large as to make decisions based on a high likelihood of receiving treatment.

7. The sample was not stratified because all firms were owned by men in a particular age range operating in the same broad industry in the same city. Simulations on microenterprises in Bruhn and McKenzie (2008) suggest that with the sample size and the microenterprise data used here, the choice of randomization method is unlikely to matter much in terms of either balance or power.

TABLE 2. Baseline Characteristics of Treatment and Control Groups

Characteristic	Assigned to treatment group	Assigned to control group
Age of owner (years)	37.1	36.7
Age of business (years)	5.2	5.8
Owner's education (years)	6.6	6.7
Mother's education (years)	3.5	3.8
Father's education (years)	4.1	4.1
Father owned a business [1 = yes]	0.40	0.48
Profits in Round 1 (pesos)	3,433	3,312
Sales in Round 1 (pesos)	6,063	6,024
Non-land-owned capital in Round 1 (pesos)	4,342	4,358
Traveling locale [1 = yes]	0.37	0.49
Unregistered [1 = yes]	0.66	0.65
Does not keep business records [1 = yes]	0.58	0.55
Owens house with title [1 = yes]	0.46	0.48
Household size (number)	4.70	4.21
Number of working adults in household	1.17	1.30
Ever had supplier credit [1 = yes]	0.32	0.31
Number of firms	130	77

Source: Authors' analysis based on the data from 2005/06 sample survey in León, Mexico.

others (2008). This mixture of grants was intended to determine whether restricted (in-kind) or unrestricted (cash) grants have different impacts. For in-kind purchases, a member of the survey team accompanied each firm to purchase whatever inputs or equipment the enterprise owner chose, under the condition that the purchase had to be for the enterprise. Cash was given without restrictions on its use. Owners were allowed to contribute funds of their own to purchase items costing more than 1,500 pesos (in practice none did). All but two firms provided with equipment grants purchased inventories or raw materials. Two purchased display cases for goods. A total of 87 firms received treatment after one of the rounds; the remaining firms did not receive any treatment. The 1,500-peso treatment represented just over a quarter of the mean or median baseline capital stock and half of median monthly profits for the enterprises. Thus, it was a substantial shock for the enterprises.

Comparison of baseline characteristics of firms assigned to treatment and control groups reveals that the randomization was successful in creating groups that were comparable in observable characteristics of owners and their firm (table 2).<sup>8</sup> The average owner was 37 years old, and had 6.7 years of education. The majority of firms were not registered and did not keep business records. Just under half of the firms had a traveling locale, meaning that the business did not operate out of fixed premises.

8. Because assignment to groups was done randomly (meaning that by definition any such differences are due to chance), *P*-values for testing differences between the two groups are not reported. See Bruhn and McKenzie (2008) for discussion of this point.

TABLE 3. Sample Size, by Survey Round

Round	Ex ante design			Actual sample <sup>a</sup>			Total
	Assigned to control group	Assigned to treatment group	Treated this round	Control	Treatment	Noncompliers <sup>b</sup>	
1	207	0	0	198	0	0	198
2	194	13	9	155	8	3	166
3	162	45	31	110	25	6	141
4	118	89	68	83	59	2	144
5	77	130	87	47	71	10	128

<sup>a</sup>Observations in sample with nonmissing profit data.

<sup>b</sup>Firms that were assigned to receive a treatment but did not receive it. The majority of these firms did not receive a treatment because they had dropped out of the survey by the time they would have received treatment. However, some firms assigned to treatment remained in the survey but were not given the treatment because the survey firm could not locate the firm owner at the treatment should have been provided. Five of these firms were treated in a later round.

Source: Authors' analysis based on the data from 2005/06 sample survey in León, Mexico.

TABLE 4. Cumulative Attrition Rates, by Survey Round

Round	Attrition rate				With 5 percent trimming	
	Assigned to control group	Assigned to treatment group	Received treatment	Noncompliers	Assigned to control group	Assigned to treatment group
2	0.20	0.15	0.11	0.25	0.49	0.46
3	0.32	0.31	0.19	0.57	0.52	0.56
4	0.30	0.31	0.13	0.90	0.49	0.53
5	0.39	0.38	0.18	0.77	0.58	0.55

Note: Attrition measured as either not in round or in round with missing profits.

Source: Authors' analysis based on data from 2005/06 sample survey in León, Mexico.

#### *Staggering of Treatment, Attrition, Noncompliance, and Noise*

The sample initially included 198 of the 207 firms reporting profits in the baseline survey (table 3). The number of firms dropped in each subsequent round: only 128 firms were in the survey and reported profits by the last round (table 4). The attrition rates are very similar for firms assigned to control and treatment, beginning at 15–20 percent at the start of the second round and climbing to 38–39 percent by the fifth round. Some of the attrition was reportedly caused by migration to the United States; most of it came from refusals to continue to participate and from the inability of the survey firm to relocate some firm owners in subsequent rounds.<sup>9</sup> These rates of attrition are similar to those in the quarterly labor force panel surveys undertaken by the Mexican

9. The business locations for many firms are at most semifixed, with low costs of moving to new locations to take advantage of market opportunities in a different part of the city.

government's statistical agency (Instituto Nacional de Estadística, Geografía, e Informática). Antman and McKenzie (2007) report an attrition rate of 35 percent over five quarters among 25- to 49-year-old household heads with wage or self-employed earnings. The fact that the attrition rates are so similar for treatment and control groups suggests that under plausible assumptions (detailed in Section III) attrition will not bias the estimates of the treatment effect. This issue is returned after the main results are presented.

Attrition is much lower among firms that actually received treatment, with only 18 percent of the treated firms dropping out by Round 5. There are several possible reasons for lower attrition among treated firms. First, in order to receive a treatment, a firm assigned to treatment had to stay in the survey and be able to be located at the time of receiving treatment. Many of the firms assigned to treatment dropped out before they were scheduled to receive treatment. Second, treatment might increase the likelihood of firm owners agreeing to continue responding to the survey, through some sense of obligation or better appreciation of the survey after receiving a prize from it. Third, treatment may prevent some firms that would have gone out of business from doing so, keeping them in the sample longer.

The selection effect can be addressed by conditioning on individuals still in the sample. The selection accounts for the majority of the difference in attrition rates between those assigned and those not assigned to treatment. A probit regression of the probability of dropping out between time  $t-1$  and  $t$ , conditional on being in the survey at time  $t-1$ , gives a marginal effect of being treated of 0.08, with a  $P$ -value of 0.068. This suggests that treatment has some effect on the likelihood of a firm staying in the sample. It is not possible to determine whether firms drop out because they go out of business or because they refuse to continue to participate in the study.

In addition to attrition and noncompliance, a third factor that must be considered when estimating the effect of treatment is the high volatility of the monthly profit data reported by firms. Profits vary both across firms and for the same firm over time. In Round 1, the mean profits across firms is 3,410 pesos, with a standard deviation of 2,198, yielding a coefficient of variation of 0.64. The percentage change in a firm's monthly profits from one round to the next ranges from  $-97.6$  to  $+4,110$  percent. Fitting an AR(1) model with a constant to profits gives an autoregressive coefficient of only 0.31 ( $P = 0.000$ ) on the quarterly lag, a surprisingly low degree of autocorrelation.

Some of this variation is undoubtedly genuine, reflecting productivity shocks, seasonality, growth, and decline. However, a substantial amount of the variation is likely to be noise. Less than 7 percent of firms use formal methods to keep business records, 34 percent use personal notes, and 58 percent keep no business accounts at all. For almost all firms, estimation of firm profits is thus based on recall and personal notes, which are likely to be subject to reporting error. Some of the estimation is therefore done by eliminating firms that have a percentage change in profits in the top or bottom tails of the

percentage change in profits distribution. Trimming the top and bottom 5 percent means dropping firms with a change in monthly profits, that is less than  $-75$  percent or greater than  $280$  percent from one quarter to the next.<sup>10</sup>

Trimming the top and bottom 5 percent increases overall attrition to 55–58 percent by the fifth round, with only a minor difference in attrition by control and treatment groups. This trimming greatly increases the autocorrelation of profits. Estimating an AR(1) model with a constant for the subset of firms left after trimming the top and bottom 5 percent of percentage changes gives an autocorrelation coefficient of 0.62 ( $P = 0.000$ ), exactly twice the 0.31 value in the no trimming case.

Figure 1 displays the profits data for firms that had and had not been treated at each wave, plotting real profits in each of Rounds 2 through 5 against baseline profits. The top panel shows the results with no trimming. The much larger vertical scale than horizontal scale shows that a few firms report extremely large changes in profits and makes it hard to see what is happening for the majority of the firms. Moreover, with the vertical scale going to 50,000, one cannot see the 495-peso mean difference in treated and untreated firms, so the fitted line is not shown. Trimming the top and bottom 5 percent of changes in profits removes the largest outliers, allowing the gap in fitted mean profits between treated and untreated firms to be clearly seen (bottom panel).<sup>11</sup> This difference in mean profits between firms receiving treatment and firms not receiving treatment is a naive estimate of the treatment effect. It will be equal to the average treatment effect on the treated (ATT) only if there is no selection into treatment among firms assigned to treatment. Section III shows how to estimate the ATT even when there is selection into the treatment among those randomly assigned to receive it.

### III. ESTIMATION OF THE TREATMENT EFFECT AND RESULTS

This section begins with the estimation of the treatment effect and then presents the estimates of the intention-to-treat (ITT) effect and of the treatment effect on the treated.

#### *Estimation of the Treatment Effect*

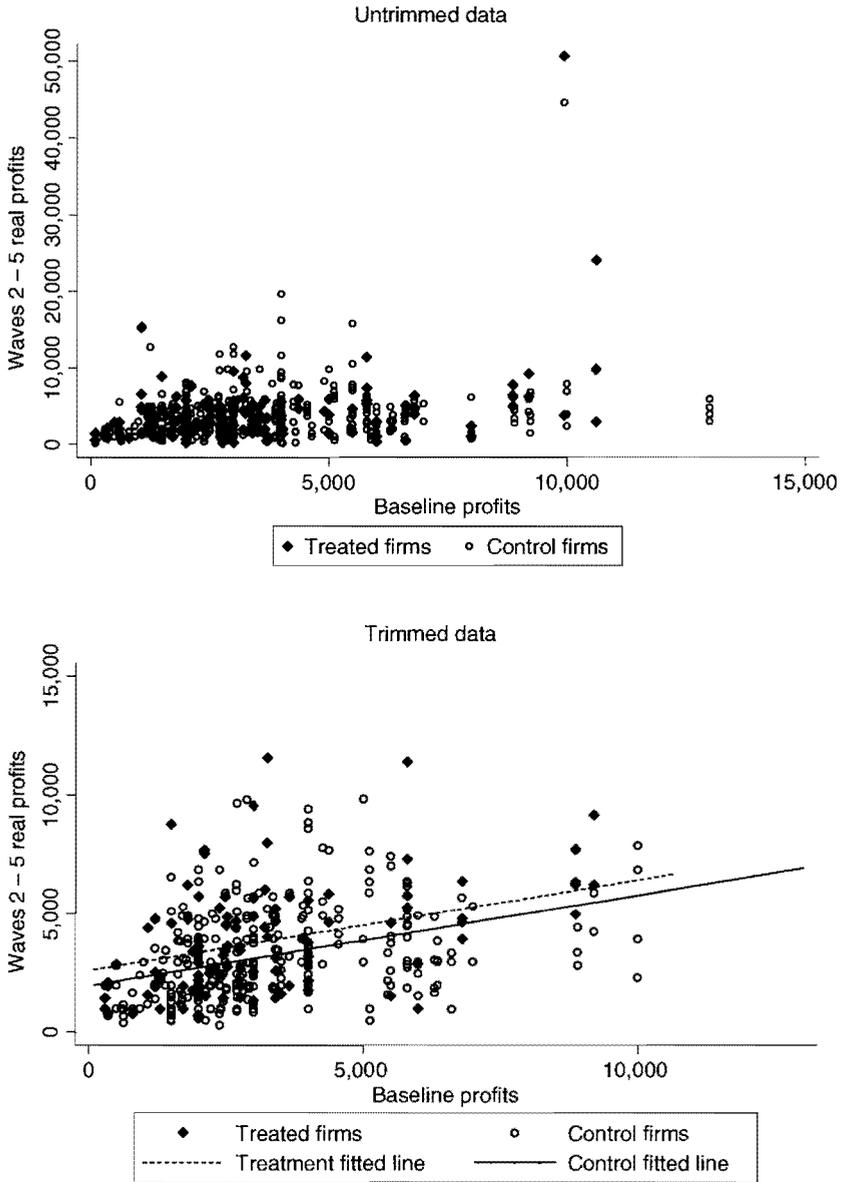
Estimating the mean effect of being assigned to treatment on business profits requires estimating for firm  $i$  in period  $t$ :

$$(1) \quad \text{PROFITS}_{i,t} = \alpha + \beta Z_{i,t} + \sum_{s=2}^5 \delta_s + \varepsilon_{i,t}$$

10. Results are similar, but not as precise, when the top and bottom 1 percent are trimmed. Results available on request.

11. The fitted line is Real profits ( $t$ ) =  $a + b \times$  treated by time  $t + c \times$  baseline profits +  $e$ , where the error term is clustered at the firm level.

FIGURE 1. Real Profits in Baseline and Follow-up Rounds, before and after Trimming Large Changes in Profits



Note: Trimming removes firms with a change in profits above the 95th percentile of change in profits (>280 percent) or below the 5th percentile (less than -75 percent). The fitted line in the bottom panel is an ordinary least squares regression of real profits on a dummy variable for treatment and on baseline profits. The coefficient on treatment is 643, with a standard error clustered at the individual level of 268 ( $P = 0.018$ ).

Source: Authors' analysis based on 2005/06 sample survey in León, Mexico.

where  $Z_{i,t}$  is an indicator of whether firm  $i$  has been assigned to treatment at time  $t$ , and  $\delta_s$  are period effects. The cash and equipment treatments are pooled into a single treatment for greater power (the two groups are separated later). The coefficient  $\beta$  gives the average effect of being assigned to treatment, also known as the ITT effect. Randomization means that the expected correlation between the error term  $\varepsilon_{i,t}$ , and  $Z_{i,t}$  is zero, implying that ordinary least squares can be used to estimate equation (1), clustering the error term at the firm level. However, because there are multiple observations for the same firms, the error term  $\varepsilon_{i,t}$  is likely to have a firm-specific component that can be controlled for through random-effects estimation. As a further check, fixed-effects estimation is also carried out. The advantage of fixed effects is that they will capture any time-invariant firm characteristics that affect profits. As shown in table 2, randomization appears to have provided comparable assignment to control and treatment, making this less necessary. A second possible use of fixed effects is to potentially increase the precision of the results, by lowering the residual variance. Because profit data are believed to be subject to measurement error, however, using fixed effects may decrease the signal-to-noise ratio, thereby reducing precision.

The ITT effect shows the overall impact of the experiment. Interest in this parameter by policy makers may be limited, because the experiment does not examine the implementation of an actual program. Given the success of the Progres/Oportunidades program in using conditional cash transfers to reduce poverty, however, it is conceivable that governments may consider conditional cash transfers to low-income firm owners as another form of poverty alleviation.

For most policy purposes, policy makers would like to know the impact of actually receiving the treatment,  $\lambda$ , in the following equation:

$$(2) \quad \text{PROFITS}_{i,t} = \theta + \lambda \text{TREAT}_{i,t} + \sum_{s=2}^5 \pi_s + v_{i,t}$$

where  $\text{TREAT}_{i,t}$  is an indicator of whether firm  $i$  actually received treatment by time  $t$ . The coefficient  $\lambda$  can be estimated using  $Z_{i,t}$  (whether or not a firm was assigned to treatment) as an instrument for receiving treatment. This estimate, known as the local average treatment effect (LATE), can be interpreted as the effect of the treatment on individuals who receive treatment after being assigned to treatment. Angrist (2004) demonstrates that in situations in which no individuals who are assigned to the control group receive the treatment, as is the case here, the LATE is the same as the ATT. As with estimation of equation (1), estimation of equation (2) allows the error term to be clustered at the firm level, has a random effect, or has a fixed-effects component.

### Results

Consider first the ordinary and two-stage least squares results (table 5). The ITT estimates range from 543 to 603 pesos; the treatment effect on the treated (TOT) estimates range from 608 to 685 pesos. Comparing these results with the treatment given to firms of 1,500 pesos (about \$140) reveals a very large treatment effect. With 5 percent trimming, the TOT effect is equivalent to a 46 percent return on the treatment, significant at the 10 percent level. The random-effects estimates show slightly smaller treatment effects, with the TOT ranging from 264 to 527 pesos. After 5 percent trimming, the TOT is equivalent to a 35 percent return on the treatment, significant at the 5 percent level.

The raw results from fixed-effects estimation are the only exception to the pattern of large treatment effects. The TOT effect is  $-19.4$  pesos, with a standard error of 449. This appears to be a result of the noise in the data swamping any signal once the fixed effects are taken out. Indeed, as the data are trimmed and the amount of noise reduced, the fixed-effects estimates also show positive treatment effects. The TOT effect with 5 percent trimming is 432 pesos, corresponding to a 28.8 percent return. The  $P$ -value is 0.141, close to a standard significance level even after having removed a large amount of the signal from the data.

The results from table 5 show the treatment effects that are significant for two-stage least squares and instrumental variables random-effects estimation and marginally significant for instrumental variables fixed-effects estimation after 5 percent trimming. The estimated treatment effect ranges from 28.8 to 45.6 percent. It is well identified only for the subset of firms without very noisy profit data that take up the treatment when assigned.

Interpreting the TOT as a return to capital requires assuming that the treatment affects profits only through changes in the capital stock. The firms in the survey had no paid employees, and over the short time it seems unlikely that the treatment affected management ability or total factor productivity. Thus, the only other channel through which the treatment may have affected profits is adjustments in the labor supply of the owner. Estimating equation (1) with own hours as the dependent variable gives an ITT effect of  $-3.7$ , with a  $P$ -value of 0.09. This falls to an effect of  $-2.1$  and a  $P$ -value of 0.27 when hours are restricted to be above zero and below 100 a week. Ignoring the changes in own hours is justified by the lack of significance after removing outliers; it leads the estimates to be a lower bound on returns to capital. Alternatively, an ordinary least squares regression on the baseline data suggests that the marginal value of one additional hour of own labor is 15 pesos. Valuing the fall in labor at this rate would raise the random-effects treatment effect in column 4 of table 5 from 527 to 724 pesos, increasing the return to capital to 48 percent.

**POOLING CASH AND EQUIPMENT TREATMENTS.** The analysis so far has pooled the cash and equipment treatments. The first two columns of table 6 report the results of allowing the effect of the treatment to vary according to the form it

TABLE 5. Treatment Effects (Dependent Variable: Monthly Profits, in October 2005 Pesos)

Item	(1)		(2)		(3)		(4)		(5)		(6)	
					Intention to treat effect							
	Ordinary least squares		Random effects		Random effects		Fixed effects		Fixed effects		Fixed effects	
	Untrimmed	Trimmed	Untrimmed	Trimmed	Untrimmed	Trimmed	Untrimmed	Trimmed	Untrimmed	Trimmed	Untrimmed	Trimmed
Assignment to treatment	543.1 (455)	602.9* (343)	227.5 (348)	459.4** (231)	-16.71 (387)	370.2 (252)						
<i>p</i> -value	0.234	0.081	0.514	0.047	0.966	0.142						
Constant	3,409*** (176)	3,244*** (183)	3,419*** (282)	3,284*** (193)	3,474*** (225)	3,339*** (146)						
Treatment effect on the treated												
	Two-stage least squares		Instrumental variables random effects		Instrumental variables fixed effects							
Treatment	608.2 (503)	684.5* (383)	263.8 (398)	526.5** (266)	-19.37 (449)	431.8 (293)						
<i>P</i> -value	0.227	0.074	0.507	0.048	0.966	0.141						
Constant	3,409*** (175)	3,244*** (181)	3,419*** (281)	3,284*** (194)	3,474*** (225)	3,338*** (146)						
Trimming (percent)	None	5	None	5	None	5						
Number of firm-period observations	715	504	715	504	715	504						
Number of firms	161	113	161	113	161	113						
Implied monthly return (percent)	40.5	45.6	17.6	35.1	-1.3	28.8						
Lee bounds for treatment effect (percent)		[31.6, 42.9]		[24.5, 37.5]		[19.1, 31.3]						

\*\*\*Significant at the 1 percent level; \*\*significant at the 5 percent level; \*significant at the 10 percent level.

*Note:* Numbers in parentheses are standard errors, which are clustered at the firm level for ordinary and two-stage least squares. Estimation is restricted to firms in the sample for three or more rounds. All regressions include period effects. Assignment to treatment is used as an instrument for receiving treatment in lower panel. See text for description of how Lee bounds are calculated.

*Source:* Authors' analysis based on data from 2005/06 sample survey in León, Mexico.

TABLE 6. Robustness of Results to Pooling Treatments and Spillovers (Dependent Variable: Monthly Profits; October 2005 Pesos)

Item	(1) Instrumental variables random effects	(2) Instrumental variables fixed effects	(3) Instrumental variables random effects	(4) Instrumental variables random effects	(5) Instrumental variables fixed effects	(6) Instrumental variables fixed effects
Equipment treatment	600.0** (304)	264.2 (334)				
Cash treatment	435.8 (373)	658.1 (413)				
Treatment			526* (271)	529* (271)	429 (299)	432 (299)
Number of neighbors assigned to treatment			5.3 (34.0)		3.8 (38.4)	
Number of neighbors who received treatment				15.3 (43.6)		11.4 (50.5)
Constant	3,283 (193)***	3,341 (145)***	3,298 (197)***	3,298 (198)***	3,354 (148)***	3,353 (148)***
Number of observations	504	504	495	495	495	495
Number of firms	113	113	111	111	111	111

\*\*\*Significant at the 1 percent level; \*\*significant at the 5 percent level; \*significant at the 10 percent level.

*Note:* Numbers in parentheses are standard errors. Estimation trims the top and bottom 5 percent of changes in profits. Regressions also include period effects. Assignment to equipment and cash treatments are used as instruments for receiving cash and equipment in columns 1 and 2. Assignment to treatment is used as an instrument for receiving treatment in columns 3–6.

*Source:* Authors' analysis based on data from 2005/06 sample survey in León, Mexico.

is given in. Under random effects, the TOT is 600 pesos for the equipment treatment and 436 pesos for the cash treatment. The null hypothesis that the two effects are equal in size, justifying pooling the treatments, cannot be rejected. Using fixed effects generates a larger point estimate for the cash treatment than the equipment treatment, but the hypothesis that the two treatments have the same effect cannot be rejected. There is thus not sufficient power to rule out the null hypothesis of no difference in effects between conditional and unconditional grants to microenterprise owners.

**SPILLOVERS.** The treatment effect is estimated by comparing firms randomly assigned to treatment group with firms randomly assigned to the control group. This yields a valid estimate of the treatment effect, provided that there are no spillover effects from the treatment to the control sample. The validity of this assumption is investigated by adding the number of other firms within the same census sampling cluster (UPM) as a firm that has either been assigned to treatment or actually received treatment. Over Rounds 2 through 5, the median firm had 1, the mean had 2.1, and the 90th percentile had 7 firms receiving treatment in the same UPM. The spillover effect is estimated to be small, positive, and not statistically significant; the coefficients on the treatment effects are very similar to those shown in table 5. Thus, there does not seem to be any evidence of spillover effects. The treatment effects can thus be interpreted as pure treatment effects.

**ATTRITION.** One potential concern is whether the process of trimming combined with attrition could be biasing the results. Attrition rates are similar for firms assigned to the control and treatment groups. However, after 5 percent trimming, attrition after five rounds is 58 percent for the control group and 55 percent for the group assigned to treatment. The bounding approach of Lee (2005) is used to construct upper and lower bounds for the treatment effect in order to examine the robustness of the results to this differential attrition.<sup>12</sup>

The key identifying assumption required for implementing the Lee bounds is a monotonicity assumption that posits that treatment assignment affects sample selection in only one direction. In the present context, it requires assuming that some firms would have dropped out if they had not been assigned to treatment but that firms do not drop out because they are assigned to treatment. This seems plausible, as firms receiving treatment may be less likely to

12. An alternative approach is to model attrition parametrically and use the predicted model to reweight the data. However, attrition is not related to the age of the firm, education of the owner, whether or not the firm is registered, baseline profits, the type of location of firm, or household size. A parametric correction for attrition by using weighted least squares to account for differences in the probability of staying in the sample of different firms increases the two-stage least squares estimate from 685 to 806. With a standard error of 425, the hypothesis that there is no change in the coefficient from attrition cannot be rejected, but if anything this parametric correction for attrition increases the estimated return to capital.

fail and more likely to be willing to answer the survey question. It does not appear likely that receiving treatment would have caused some firms to drop out of the survey that would not have dropped out if they had remained in the control group.

To construct the Lee bounds, one trims the distribution of profits for the group assigned to treatment by the difference in attrition rates between the two groups as a proportion of the retention rate of the group assigned to treatment. A lower (upper) bound on the treatment effect is constructed by trimming the upper (lower) tail of the distribution. This requires trimming the upper or lower 6.7 percent of the profits distribution for the group assigned to treatment.

The last row of table 5 provides the upper and lower Lee bounds for the TOT effect after 5 percent trimming, adjusting for differential attrition between the groups assigned to control and treatment. As a result of the skewed distribution of profits, the point estimates in table 5 are much closer to the upper bounds than to the lower bounds. The lower bound for the treatment effect is 19.1 percent for the instrumental variables fixed-effects estimate, 24.5 percent for the instrumental variables random-effects estimate, and 31.6 percent for the two-stage least squares estimate. Thus, in all cases, even the lower bound shows a large effect of the treatment.

#### IV. RETURNS AND ACCESS TO FINANCE

In Mexico, returns are much higher than interest rates offered by banks and microfinance firms. The leading explanation for such high returns is that many of the firms are credit constrained, causing them to operate below their efficient size. If this is the case, one should expect firms that are more credit constrained to have higher returns from the treatment. This possibility is explored by interacting the treatment effect with different measures of whether or not a firm is credit constrained, using the following estimation equation:

$$(3) \quad \text{PROFITS}_{i,t} = \theta + \lambda \text{TREAT}_{i,t} + \varphi \text{TREAT}_{i,t} * \text{UNCONSTRAINED}_i \\ + \sum_{s=2}^5 \pi_s + \sum_{s=2}^5 \delta_s * \text{UNCONSTRAINED}_i + \nu_{i,t}$$

where the period effects are allowed to vary with the measure of whether or not firm  $i$  is financially constrained. The level effect for being unconstrained is also included in this regression when random effects are used, but it drops out when fixed effects are used. Assignment to treatment and the interaction of assignment to treatment with being unconstrained are used as instruments for receiving treatment and its interaction with being unconstrained.

The data provide several possible measures of access to finance and financial constraints from the baseline survey (table 7). The first is a question that asks

TABLE 7. Impact of Credit Constraint on Treatment Effects

Item	(1) Instrumental variables random effect	(2) Instrumental variables fixed effect	(3) Instrumental variables random effect	(4) Instrumental variables fixed effect	(5) Instrumental variables random effect	(6) Instrumental variables fixed effect	(7) Instrumental variables random effect	(8) Instrumental variables fixed effect
Treatment	1,148 (345)***	1,010 (374)***	633.3 (290)**	470.5 (322)	790.0 (330)**	611.7 (357)*	-56.87 (336)	-194.6 (376)
Treatment * says finance not constraint	-1662 (537)***	-1616 (594)***						
Treatment * ever had a formal loan			-808.8 (727)	-457.4 (769)				
Treatment * ever had supplier credit					-777.8 (559)	-566.9 (625)		
Treatment * financially superconstrained							1,528 (555)***	1,585 (605)***
Constant	3,443 (238)***	3,342 (145)***	3,079 (213)***	3,335 (145)***	3,447 (235)***	3,337 (145)***	3,323 (252)***	3,339 (145)***
<i>P</i> -value for Chi-squared test of no effect for financially unconstrained firms	0.212	0.189	0.793	0.985	0.978	0.931	0.865	0.604
Number of firm-period observations	504	504	504	504	504	504	504	504
Number of firms	113	113	113	113	113	113	113	113

\*\*\*Significant at the 1 percent level; \*\*significant at the 5 percent level; \*significant at the 10 percent level.

*Note:* Numbers in parentheses are standard errors. Results for sample with 5 percent trimming of firms based on percentage change in profits. All regressions include period effects and interactions between period effects and the interaction variable. Random effects regressions also include the level effect for the variable being interacted. Financially superconstrained firms are defined as firms that report that finance is a constraint and never had a bank loan or supplier credit.

*Source:* Authors' analysis based on data from 2005/06 sample survey in León, Mexico.

firm owners whether lack of finance is an obstacle to the growth of their business. Sixty-four percent of firm owners report that it is a constraint. Owners with more education and whose father owned a business are less likely to report that finance is a constraint. The other measures are objective measures of the use of finance: whether or not firms had ever used formal finance or supplier credit at the time of the baseline survey. Firm owners with previous use of formal loans or supplier credit may be less financially constrained than other owners. Just 15.6 percent of firms had ever had a formal loan, and 31.7 percent had ever had supplier credit. Formally registered firms are more likely to have had a formal loan or supplier credit. However, the measures of use of finance are only very weakly positively correlated with self-reporting that finance is not a constraint, with a correlation between reporting that finance is not a constraint and having previously had a formal loan of just 0.036.

Estimates of the treatment effects allowing for interactions between treatment and different measures of lack of financial constraints are reported after again eliminating firms with percentage changes in profits below the 5th percentile or above the 95th percentile. Columns 1 and 2 of table 7 show a large and strongly significant interaction effect between treatment and whether a firm owner reports that finance is not a constraint to business growth. One cannot reject the possibility that firms that report that finance is not a constraint have no increase in profits from the treatment (the point estimate actually shows a decrease in profits). The treatment effect is much stronger for the 64 percent of firms that report that finance is a constraint: monthly profits increase 1,051–1,192 pesos for these firms, a 70–79 percent return. Similar but less significant interaction effects are found for the measures of previous use of credit. One cannot reject the possibility that there is no treatment effect for firms that previously had formal loans or supplier credit; the treatment effect for financially constrained firms is always positive, and it is significant in all but one case (firms that have not had a formal loan).

The different measures are combined to create a set of firms that report that finance is a constraint to business growth and that have never had a formal loan or supplier credit. The 38 percent of firms that fall into this category are referred to as “financially superconstrained.” Interacting this variable with the treatment increases the profits among these firms by 1,430–1,515 pesos—an incredible 100 percent return.

## V. DISCUSSION AND CONCLUSION

Returns to capital are difficult to measure because of numerous problems. Among the smallest firms, managed by their owners, both the firm’s profits and the level of capital stock may be correlated with the unmeasured ability of the owner, with unmeasured factors affecting demand for the firm’s products, or

with both. These issues are overcome in a sample of small retail enterprises in Mexico by generating random shocks to capital stock in a field experiment.

The data imply that profits increase by 300 to 1,500 pesos (for superconstrained firms), a 20–100 percent monthly return on the 1,500 pesos given to treated firms. Such large estimates are plausible for several reasons. First, the analysis is limited to firms in the retail sector with replacement costs of capital less than \$900 whose owners work full time in the enterprise. Using a broader sample of Mexican enterprises, McKenzie and Woodruff (2006) find average monthly returns on capital of 10–20 percent for firms with capital stock below \$200. For firms with capital stock of \$500–\$1,000, they find returns on capital in the 5 percent range.

Second, the treatment effect is negligible for firms that report no financial constraints (see table 7). The results, therefore, reflect the experience of a relatively select group: firms with capital stock near \$200 that report being financially constrained.

Borrowers from microfinance institutions may match these characteristics reasonably well. Being a client of such an institution is evidence that an individual feels financially constrained; many clients are likely to operate microenterprises in sectors that require only a small amount of capital. Compartamos, the largest pure microlender in Mexico, charges an average annual interest rate of 105 percent on loans made primarily to solidarity groups composed of three to eight women.<sup>13</sup> Such groups are liable for any default; members thus have a strong incentive to monitor and assist one another to ensure repayment. Without group liability, one would expect lending rates to be higher.<sup>14</sup> Using the lower bound for the treatment effect (roughly 25 percent), a treated firm could repay a 1,500 peso loan in four to five months. Thus, the interest rates charged by Mexican microlenders, though high by the standards of microlenders in other countries, are affordable to the segment of the population represented by the sample firms. If the annual rate on an individual loan were twice that of a loan to a solidarity group, sample firms would still, on average, be able to repay the loan from profits earned. That the rates charged by the largest microlender are roughly similar to the estimates provides support for the plausibility of the regressions.

Additional support for the notion that returns are especially high for the type of firms in the sample comes from comparisons with microlenders that focus on larger firms. The MIX Market, a Web-based platform for the global exchange of information in the microfinance industry, provides data on four leading Mexican microlenders. These data suggest that return on

13. The interest rate figure comes from Carlos Labarthe, the co-CEO of Compartamos, as reported in Bruck (2006). When all costs are considered, the actual interest rate on some Compartamos loans is near 120 percent.

14. The exact role of group compared with individual liability is still being debated. Giné and Karlan (2006) suggest that switching from group to individual liability does not affect repayment rates.

equity and average loan size are negatively correlated. Caja Popular Mexicana had an average loan size of \$1,429 and a return on equity of 10.5 percent in 2005. Compartamos and Finca México, which focus on small borrowers (with average loan sizes of \$399 and \$242), had much higher returns on equity (55.2 and 34.2 percent).<sup>15</sup> FinComun falls between the two group for both measures, with loans averaging \$635 and a return on equity of 25.2 percent. The data thus suggest that returns are highest for microfinance institutions that make small loans. Those institutions have loan sizes substantially larger than the \$140 received by treated firms in the experiment. Given the peculiarities of the Mexican context, the returns estimated here are thus not implausible.

The high returns to capital at these very low levels of capital stock have several important implications. First, they suggest that there is no minimum investment threshold below which returns to capital are so low that entry into self-employment is discouraged. This suggests that capital constraints operating through occupational choice is not a cause of permanent poverty traps. Capital constraints are still plausibly a source of some inefficiency. The finding that returns are highest among the most constrained enterprises supports this notion. Capital may not flow to these firms despite high returns for a number of reasons, including the cost of servicing small loans, lack of collateral, a weak contracting environment, and large information asymmetries (Morduch 1999).

Second, the existence of high returns contributes to the debate on how best to increase the access to financial services among the poor (Morduch 1999; Armendáriz and Morduch 2007). One view is that it can be profitable to do so only with highly subsidized interest rates (provided through subsidized microfinance institution or government banks). A contrasting view is that at least some of the poor have the capacity to repay loans at much higher rates, enabling microfinance institutions to be self-sustaining. The results presented here show that the average financially constrained microenterprise in the retail trade sector has very high returns, at a level sufficient for it to be able to repay high interest rates.<sup>16</sup> But these high returns also present a puzzle. On average, the enterprises in the sample are five years old. Given the high returns to capital in the enterprises and the lack of any investment threshold, one might wonder why the owners have not grown on their own accord by reinvesting profits from the enterprise. This is a topic for future research.

15. Finca México is a so-called village lender, a group lending technology in which each branch forms a single, large group and is given a degree of self-governance. This could explain why its return on equity is lower than that of Compartamos despite having a smaller average loan size.

16. Of course, one reason why the returns are so high is that these firms are financially constrained. Given rapid expansion in access to credit, one would expect these returns to fall. Currently, returns are high enough for interest rates not to be the main constraint to access to financial services.

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# How Important Are Financing Constraints? The Role of Finance in the Business Environment

*Meghana Ayyagari, Asli Demirgüç-Kunt, and Vojislav Maksimovic*

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What role does the business environment play in promoting or restraining firm growth? Recent literature points to a number of factors as obstacles to growth. Inefficient functioning of financial markets, inadequate security and enforcement of property rights, poor provision of infrastructure, inefficient regulation and taxation, and broader governance features such as corruption and macroeconomic stability are all discussed without any comparative evidence on their ordering. Using firm-level survey data on the relative importance of different features of the business environment, the article finds that although firms report many obstacles to growth, not all the obstacles are equally constraining. Some affect firm growth only indirectly through their influence on other obstacles, or not at all. Analyses using directed acyclic graph methodology and regressions find that only obstacles related to finance, crime, and policy instability directly affect firm growth. The finance result is shown to be the most robust. The results have important implications for the priority of reforms. Maintaining policy stability, keeping crime under control, and undertaking financial sector reforms to relax financing constraints are likely to be the most effective routes to promote firm growth. JEL codes: D21, G30, O12

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Firm growth is at the center of the development process, making it a much researched area in finance and economics. The field has seen resurgence in interest from policymakers and researchers, with a new focus on the broader business environment in which firms operate. Through surveys, researchers have documented that firms report many features of their business environment as obstacles to their growth. Firms report being affected by inadequate security

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and enforcement of property rights, inefficient functioning of financial markets, poor provision of infrastructure services, inefficient regulations and taxation, and broader governance features such as corruption and macroeconomic instability. Many of these perceived obstacles are correlated with low firm performance.

These findings can inform government policies that shape the opportunities and incentives facing firms, by influencing their business environment. But even if firm performance is likely to benefit from improvements in all dimensions of the business environment, addressing all of them at once would be challenging for any government. Thus, understanding how these different obstacles interact and which ones influence firm growth directly is important in prioritizing reform efforts. Further, since the relative influence of obstacles may also vary with the level of development of the country and with firm characteristics such as size, it is important to assess whether the same obstacles affect all subpopulations of firms.

This article identifies the features of the business environment that directly affect firm growth, using evidence from the World Business Environment Survey (WBES), conducted by the World Bank in 1999 and 2000 in 80 developed and developing economies around the world. These data are used to assess whether each feature of the business environment that firms report as an obstacle affects their growth, the relative economic importance of the obstacles found to constrain firm growth, whether an obstacle has a direct effect on firm growth or acts indirectly by reinforcing other obstacles that have a direct effect, and whether these relationships vary with the level of economic development and firm characteristics.

An obstacle is defined as binding if it has a significant impact on firm growth. Of the 10 business environment obstacles that firms report, only 3 emerge from the regressions as binding constraints with a direct association with firm growth: finance, crime, and policy instability. To reduce the dimensionality of the different business environment factors in a systematic structured approach, directed acyclic graph (DAG) methodology is implemented by an algorithm used in artificial intelligence and computer science (Sprites, Glymour, and Scheines 2001). The DAG algorithm also confirms finance, crime, and policy instability as the binding constraints, with other obstacles having an indirect association, if at all, with firm growth through the binding constraints.

Further tests find finance to be the most robust, in that the finance obstacle is binding regardless of which countries and firms are included in the sample. Regression analysis also shows that finance has the largest direct effect on firm growth. These results are not due to influential observations, reverse causality, or perception biases likely to be found in survey responses. Policy instability and crime, the other two binding constraints in the full sample, are driven by the inclusion of transition and African economies where, arguably, they might be the most problematic. Instrumental variable regressions also show finance to be the most robust result.

The relative importance of different factors is found to vary according to firm characteristics. Larger firms are significantly less affected by the finance obstacle, but being larger does not relax the obstacles related to crime or policy instability to the same extent.

Although firms identify many specific financing obstacles such as collateral requirements and lack of access to long-term capital, only the cost of borrowing is directly associated with firm growth. But the cost of borrowing is itself affected by imperfections in financial markets. Firms that face high interest rates also perceive that the banks to which they have access are corrupt, underfunded, and require excessive paperwork. Difficulties with posting collateral and limited access to long-term financing are also correlated with high interest rates. These obstacles are also likely to be aggravated by underdeveloped institutions.<sup>1</sup>

Several studies point to the importance of financing obstacles. Using firm-level data, Demirgüç-Kunt and Maksimovic (1998) and others provide evidence on how the financial system and legal enforcement relax firms' external financing constraints and facilitate their growth. Rajan and Zingales (1998) show that industries that depend on external finance grow faster in countries with better developed financial systems.<sup>2</sup> Although these studies investigate different obstacles to firm growth and their impact, they generally focus on a small subset of broadly characterized obstacles.

The current study is most closely related to Beck, Demirgüç-Kunt, and Maksimovic (2005) but differs significantly from that study in the question being asked, the execution, and the findings. Beck, Demirgüç-Kunt, and Maksimovic examine whether three obstacles (finance, corruption, and legal obstacles) selected on a priori grounds individually influence firm growth rates; they do not compare the obstacles to identify the most binding constraint. This is crucial since, as the current study shows, most obstacles when entered individually are significant in growth regressions. The current study also differs in methodology, since Beck, Demirgüç-Kunt, and Maksimovic do not incorporate country-fixed effects (or the DAG methodology) and have limited discussion of causality.

The current study looks at the full set of business environment obstacles—finance, corruption, infrastructure, taxes and regulations, judicial efficiency, crime, anticompetitive practices, policy instability and uncertainty, inflation,

1. Fleisig (1996) highlights the problem with posting collateral in developing and transition economies with the example of financing available to Uruguayan farmers raising cattle. While cattle are viewed as one of the best forms of loan collateral in the United States, a pledge on cattle is worthless in Uruguay. Uruguayan law requires specific description of the pledged property, in this case, identification of the pledged cows. The need to identify collateral so specifically undermines the secured transaction, since the bank is not allowed to repossess a different group of cows in the event of nonpayment.

2. Here is a parallel literature on financial development and growth at the country level. Specifically, cross-country studies (King and Levine 1993; Beck, Levine, and Loayza 2000; Levine, Loayza, and Beck 2000) show that financial development fosters economic growth. See Levine (2005) for a review of the finance and growth literature.

and exchange rate—and finds finance, crime, and policy instability to be the most binding and financial to be the most robust. Thus this study has implications for the priority of reform efforts, while the study by Beck, Demirgüç-Kunt, and Maksimovic does not.

Several qualifications need to be emphasized. First, as is common in the literature, the current study takes as given the existing population of firms in each country and studies the constraints they face. But, as described by Hausman, Rodrik, and Velasco (2008), it must be noted that in a more general setting the population of firms is itself endogenous. For example, Beck, Demirgüç-Kunt, and Maksimovic (2006) show that firm size distribution adapts to the business environment, and Demirgüç-Kunt, Love, and Maksimovic (2006) show that certain organizational forms are better adapted to specific business environments. Nevertheless, the analysis in this article can be seen as a way of identifying and targeting the most binding constraints for existing firms, conditional on having entered, but not necessarily as a way of identifying the constraints to entry. Second, this article examines cross-country firm-level regressions and therefore does not detail the experience of any single country in depth. But controlling for country-fixed effects provides useful—although not definitive—information from the cross-country set-up on the binding constraints to firm growth. Finally, in the absence of panel data and firm-fixed effects, potential reverse causality concerns are endemic to the growth literature. These issues are addressed in detail using instrumental variables.

The article is organized as follows. Section I describes the methodology. Section II discusses the data and summary statistics. Section III presents the main results. Section IV presents conclusions and policy implications.

## I. METHODOLOGY: IDENTIFICATION OF BINDING CONSTRAINTS

Numerous studies argue that differences in the business environment can explain much of the variation across countries in firms' financial policies and performance. While much of the early work relied on country-level indicators and firms' financial reports, more recent work has relied on surveys of firms, which provide data on a wide range of potential obstacles to growth.<sup>3</sup>

Surveys have identified a large number of potential obstacles to growth, making it difficult to identify the obstacles that are truly constraining. Enterprise managers may identify several operational issues, not all of them constraining. Therefore, it is necessary to identify the extent to which reported obstacles affect the growth rates of firms. An obstacle is to be considered a "constraint" or a "binding constraint" only if it has a significant impact on firm growth. Significant impact requires that the coefficient of the obstacle in

3. See Dollar, Hallward-Driemeier, and Mengistae (2005), Gelb and others (2007), Carlin, Schaffer, and Seabright (2005), and Svejnar and Commander (2007).

the firm growth regression be significant and that the enterprise managers identified the factor as an obstacle.<sup>4</sup>

To the extent that the characteristics of a firm's business environment are correlated, it is likely that many perceived business environment characteristics will be correlated with realized firm growth. It is important to sort these into obstacles that directly affect growth and those that may be correlated with firm growth but affect it only indirectly.

Since there is no theoretical basis for classifying the obstacles, empirical measures are required. The DAG methodology is used to reduce dimensionality in a structured way. The DAG algorithm begins with a set of potentially related variables and uses the conditional correlations between them to rule out possible relations among them. The final output of the algorithm is a pattern of graphs listing potential relations among the variables that have not been ruled out, which shows variables that have direct effects on the dependent variable or other variables, variables that have only indirect effects on the dependent variable through other variables, and variables that lack a consistent statistical relation with the other variables. If DAG identifies an obstacle as having a direct effect on firm growth, that obstacle would also have a significant coefficient in all ordinary least squares regressions regardless of which subset of other obstacles is entered as control variables in the regression equation. Ayyagari, Demirgüç-Kunt, and Maksimovic (2005) further illustrate the use of this methodology.<sup>5</sup>

Regression analysis is also used for further robustness tests, such as testing for possible endogeneity bias using instrumental variable methods and controlling for additional variables at the firm and country level, growth opportunities, influential observations, and potential perception biases in survey responses.

While the obstacles a firm faces depend on the institutions in each country, the obstacles are not likely to be the same for each firm in each country. Thus, the unit of analysis is the firm. As described in what follows, the regressions have country-level fixed effects.

4. In the survey, managers indicate that an obstacle is a problem by assigning it a value of 1 to 4. The significance of the coefficient in the growth regression is usually sufficient to determine whether an obstacle is binding since the mean value of all obstacles exceeds 1. But in determining the relative impact, it is important to take into account the level of the obstacles.

5. DAG analysis is related to the use of different analytical methods to identify the most reliable predictors of economic growth such as the extreme bounds analysis (EBA) used in Kormendi and Meguire (1985), Barro (1991), and Levine and Renelt (1992), and the technique in Sala-i-Martin (1997). DAG analysis has several advantages over these methods. While these methods start from an equation specified by the researcher that embodies a causal ordering that is then tested, DAG can endogenously discover the causal ordering. Moreover, whereas EBA treats one relation at a time, the graphs produced by DAG show robust relations among all the variables being analyzed, taking into account the implications of robust relations elsewhere in the system on the ordering in a specific relation.

## II. DATA AND SUMMARY STATISTICS

As the main purpose of the WBES is to identify obstacles to firm performance and growth around the world, it contains many questions on the nature and severity of different obstacles. Specifically, firms are asked to rate the extent to which finance, corruption, infrastructure, taxes and regulations, judicial efficiency, crime,<sup>6</sup> anticompetitive practices, policy instability and uncertainty, and macro issues such as inflation and exchange rate constitute obstacles to their growth.

In addition to the detail on obstacles to growth, one of the great values of this survey is its wide coverage of smaller firms. The survey is size-stratified, with 40 percent on observations on small firms (defined as employing 5–50 employees), 40 percent on medium-size firms (51–500 employees), and the remainder from large firms (more than 500 employees).

The firm-level obstacles are reported in table 1. The WBES asked enterprise managers to rate each factor as an obstacle to the operation and growth of their business on a scale of 1–4, with 1 denoting no obstacle; 2, a minor obstacle; 3, a moderate obstacle; and 4, a major obstacle. Firms in high-income countries tend to face lower obstacles in all areas (panel A of table 1). In the sample of developing economies, regional analysis indicates that African firms report corruption and infrastructure as the highest obstacles, Latin American firms report crime and judicial efficiency as the highest obstacles, and Asian countries report financing as the lowest obstacle (panel B). Smaller firms face higher obstacles than larger firms in all areas except in those related to judicial efficiency and infrastructure, where the ranking is reversed (panel C).

Firm sales growth over the past three years is used as a measure of firm performance. Sales growth is used rather than productivity because productivity measures are noisier and available for a much smaller sample of firms. Information on other performance measures such as profits was not available. Appendix table A-1 reports firm growth and the obstacles firms report, averaged over all sampled firms in each country. Average firm growth across countries shows a wide dispersion, from negative rates of 20 percent for Armenia and Azerbaijan to 64 percent for Malawi and Uzbekistan. Firms report taxes and regulations to be their greatest obstacles. Inflation, policy instability, and financing obstacles are also reported to be highly constraining. In contrast, factors associated with judicial efficiency and infrastructure are ranked as the lowest obstacles faced by entrepreneurs.

The correlations among the obstacles reported by firms are significant but fairly low, with few above 0.5 (correlation matrix not shown). As expected, the two macro obstacles, inflation and exchange rate, are highly correlated, at

6. The survey includes two obstacles on crime, one capturing street crime and the other organized crime. Since the correlation between the two obstacles is higher than 70 percent, only street crime, which is more strongly correlated with firm growth, is used in the analysis.

TABLE 1. Economic Indicators and General Obstacles

Classification	GDP per capita	Firm growth	General obstacles									
			Financing	Policy instability	Inflation	Exchange rate	Judicial efficiency	Street crime	Corruption	Taxes and regulation	Anticompetitive behavior	Infrastructure
<i>A: Averaged across country income groups<sup>a</sup></i>												
High (N = 11)	21,376.34	0.19	2.19	2.2	2.04	1.93	1.81	1.71	1.59	2.67	2	1.72
Upper middle (N = 18)	4,131.817	0.19	2.75	2.62	2.54	2.27	2.13	2.38	2.29	2.93	2.18	1.99
Lower middle (N = 26)	1,984.852	0.11	3	3.14	3.1	2.94	2.31	2.72	2.73	3.24	2.59	2.31
Low income (N = 25)	435.3	0.14	2.85	2.84	3.02	2.61	2.15	2.78	2.98	2.73	2.53	2.7
<i>B: Averaged across geographic regions</i>												
Europe and North America (N = 9)	22,863.72	0.19	2.2	2.22	2.06	1.89	1.79	1.78	1.63	2.77	1.98	1.76
Latin America (N = 20)	3,022.2	0.09	2.83	3.02	2.84	2.8	2.39	2.95	2.74	3.01	2.43	2.4
Asia (N = 10)	2,772.52	0.05	2.59	2.82	2.74	2.66	1.99	2.62	2.71	2.51	2.44	2.43
Transition (N = 23)	2,417.02	0.19	3.05	2.99	3.06	2.7	2.17	2.39	2.5	3.28	2.44	2.09
Africa (N = 18)	1,115.81	0.23	2.77	2.43	2.75	2.21		2.64	2.80	2.32		2.75
<i>C: Averaged across firm size groups</i>												
Small	3,759.33	0.13	2.89	2.84	2.90	2.59	2.13	2.64	2.62	2.94	2.43	2.24
Medium	4,377.98	0.16	2.86	2.87	2.84	2.60	2.18	2.46	2.53	3.00	2.41	2.26
Large	4,365.68	0.17	2.54	2.75	2.65	2.55	2.19	2.49	2.43	2.70	2.23	2.36

*Note:* The variables are described as follows: GDP per capita is real GDP per capita in U.S. dollars averaged over 1995–99. Firm growth is the percentage change in firm sales over the past three years (1996–99). Financing, policy instability, inflation, exchange rate, judicial efficiency, street crime, corruption, taxes and regulation, anticompetitive behavior, and infrastructure are general obstacles as indicated in the firm questionnaire. They take values of 1–4, where 1 indicates no obstacle and 4 indicates a major obstacle. In panels A, B, and C, firm variables are averaged over all firms in the specified group.

<sup>a</sup>Income groups are defined according to World Bank (2005).

*Source:* Authors' analysis based on WBES data described in text.

0.58. The correlations of corruption with crime and judicial efficiency are also relatively high, at 0.55 each, indicating that in environments where corruption and crime are widespread, judicial efficiency is adversely affected. The correlation between the financing obstacle and all other obstacles is among the lowest, indicating that the financing obstacle may capture different effects than those captured by other reported obstacles. All obstacles are negatively and significantly correlated with firm growth. These relations are explored further in the next section.

### III. FIRM GROWTH AND REPORTED OBSTACLES

This section explores the link between the obstacles that firms report and firm growth rates using country-fixed effect regressions and DAG analysis. It finds that finance, crime, and policy instability are most significantly associated with firm growth, suggesting that these are the binding constraints. The results are robust to a number of checks, including variation across different firm sizes and country income levels, endogeneity concerns, removal of outliers, and perception biases. Of the individual financing obstacles, high interest rates are found to be most significantly associated with firm growth.

#### *Obtaining the Binding Constraints*

Firm growth rates are regressed on the different obstacles firms report. All regressions are estimated with firm-level data using country-level fixed effects.<sup>7</sup> The standard errors are adjusted for clustering at the country level. Specifically, the regression equations take the form:

$$\text{Firm growth} = \alpha + \beta_1 \times \text{obstacle} + \beta_2 \times \text{firm size} + \text{country-fixed effects} + \varepsilon. \quad (1)$$

The hypothesis that a reported obstacle is a binding constraint (has a significant impact on firm growth) is tested by determining whether  $\beta_1$  is significantly different from 0. Significant impact also requires that the obstacle has a value higher than 1, which is true for all obstacles.

When individual obstacles are analyzed separately, all but corruption, exchange rate, anticompetitive behavior, and infrastructure are significantly related to firm growth (table 2). The regressions explain up to 7.4 percent of the variation in firm growth across countries. The coefficients of the significant obstacles range from 0.021 for the judicial efficiency obstacle to 0.032 for the

7. In unreported regressions, the robustness of the results was also checked by including additional control variables in the regression. Specifically, adding variables at the firm level to capture a firm's industry, number of competitors, organizational structure, and whether it is government or foreign owned, an exporter, or a subsidy receiver reduces country coverage from 80 to 56 but does not significantly affect the results for individual obstacles. Of the three binding constraints identified earlier, only the policy instability obstacle loses significance. Results are similar with country random effects controlling for GDP per capita and inflation at the country level.

TABLE 2. Impact of Obstacles on Firm Growth

Variable	1	2	3	4	5	6	7	8	9	10	11	12
Constant	0.205*** (0.028)	0.165*** (0.036)	0.193*** (0.034)	0.170*** (0.029)	0.180*** (0.040)	0.140*** (0.026)	0.152*** (0.032)	0.117*** (0.029)	0.111*** (0.028)	0.126*** (0.033)	0.332*** (0.059)	0.297*** (0.047)
Size	0.003 (0.002)	0.005** (0.003)	0.004 (0.002)	0.004 (0.002)	0.005* (0.003)	0.005* (0.003)	0.005* (0.003)	0.003 (0.002)	0.005* (0.003)	0.005 (0.003)	0.004 (0.003)	0.004 (0.002)
Financing	-0.032*** (0.008)										-0.034*** (0.009)	-0.028*** (0.008)
Policy instability		-0.024*** (0.010)									-0.022* (0.013)	-0.014 (0.009)
Street crime			-0.030*** (0.013)								-0.033** (0.015)	-0.025* (0.014)
Inflation				-0.020** (0.009)							-0.002 (0.011)	
Taxes and regulation					-0.027** (0.012)						0.001 (0.013)	
Judicial efficiency						-0.021** (0.010)					-0.003 (0.009)	
Corruption							-0.017 (0.011)				0.011 (0.012)	
Exchange rates								-0.000 (0.009)				
Anticompetitive behavior									-0.004 (0.007)			
Infrastructure										-0.009 (0.008)		

(Continued)

TABLE 2. Continued

Variable	1	2	3	4	5	6	7	8	9	10	11	12
Number of firms	6,235	6,133	5,964	6,175	6,343	5,142	5,620	6,068	5,091	6,205	4,551	5,778
Number of countries	79	79	79	79	79	61	78	79	60	79	59	78
Adjusted $R^2$	0.07	0.073	0.07	0.068	0.069	0.07	0.072	0.069	0.069	0.068	0.074	0.072

\*Significant at the 10 percent level; \*\*significant at the 5 percent level; \*\*\*significant at the 1 percent level.

*Note:* Numbers in parentheses are standard errors clustered at the country level. The regression equation estimated is  $\text{firm growth} = \alpha + \beta_1 \times \text{size} + \beta_2 \times \text{financing} + \beta_3 \times \text{policy instability} + \beta_4 \times \text{inflation} + \beta_5 \times \text{exchange rates} + \beta_6 \times \text{judicial efficiency} + \beta_7 \times \text{street crime} + \beta_8 \times \text{corruption} + \beta_9 \times \text{taxes and regulation} + \beta_{10} \times \text{anticompetitive behavior} + \beta_{11} \times \text{infrastructure} + \beta_{12} \times \text{country-fixed effects} + \varepsilon$ . The variables are described as follows: firm growth is the percentage increase in firm sales over the past three years. Firm size is the log of firm sales. Financing, policy instability, inflation, exchange rate, judicial efficiency, street crime, corruption, taxes and regulation, anticompetitive behavior, and infrastructure are general obstacles as indicated in the firm questionnaire. They take values of 1–4, where 1 indicates no obstacle and 4 indicates a major obstacle. In specifications 1–10, each of the obstacle variables is included individually. Specification 11 includes all the obstacles that were significant in specifications 1–10; specification 12 includes only financing, policy instability and street crime obstacles. All regressions in specifications 1–12 are estimated using country-fixed effects with clustered standard errors.

*Source:* Authors' analysis based on WBES data described in text.

finance obstacle. Thus, for instance firms that say financing is a minor obstacle grow 3.2 percent slower than those that say finance is not an obstacle. Alternatively, a one-standard deviation increase in the financing obstacle decreases the firm growth rate by 3.6 percent.

Column 11 of table 2 includes all the significant obstacles in the regression equation. In this specification, only the finance, policy instability, and crime obstacles have a significant constraining effect on growth. Dropping the remaining obstacles from the regression (which are jointly insignificant as well), as in specification 12, shows only finance and crime as having a constraining effect on growth. The economic impact of the finance obstacle is higher than that of crime, but the difference is not statistically significant.

It is also possible to do such impact evaluation at the regional, country, or firm level, instead of at the sample mean. Looking at the mean obstacles for individual countries reported in the appendix table A-1, it is clear that the binding obstacles are not equally important in every country. For example, in Singapore, where the mean value of the binding obstacles is all close to one, the economic impact of the obstacles is much smaller than in Nigeria, where the mean value of all three obstacles is more than 3, indicating severe constraints. Thus, it is possible to use these cross-country results to do growth diagnostics at the country level as discussed in Hausmann, Rodrik, and Velasco (2008). Looking more closely at the firm level, there may be some firms in Nigeria for which the constraints are not binding (depending on the value of the obstacles they report) and some in Singapore for which they are. In fact, average values of obstacles by firm size, as shown in table 1, suggest that the three obstacles will always be more binding for smaller firms than for larger firms.

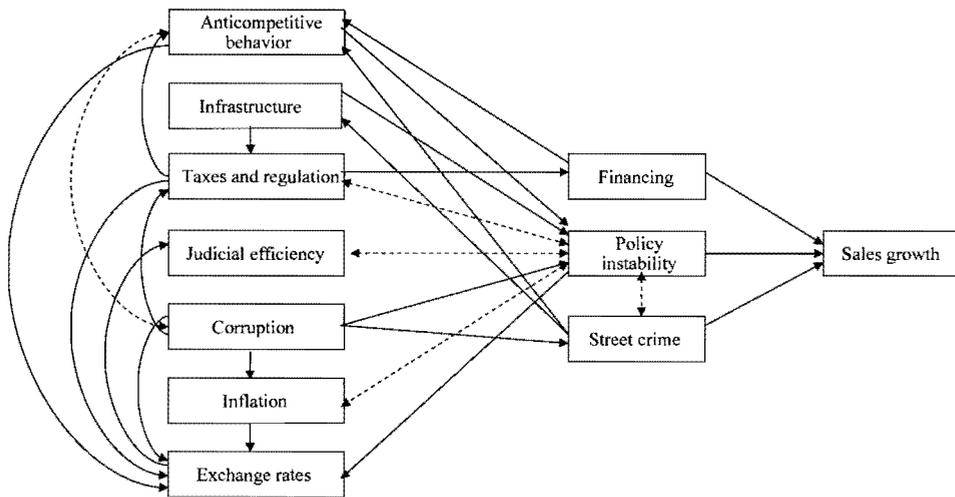
Overall, these results suggest that the three obstacles—finance, crime, and policy instability—are the only true constraints, in that they are the only obstacles that affect firm growth directly at the margin. The other obstacles may also affect firm growth through their impact on each other and on the three binding constraints, but they have no direct effect on firm growth.

#### *Have the Key Constraints Been Identified? Robustness Checks*

The DAG methodology is used to check the robustness of the regression findings since DAG is useful in simplifying the set of independent variables in a systematic way, as described in Ayyagari, Demirgüç-Kunt, and Maksimovic (2005).

The DAG analysis is implemented using the software program TETRAD III (Scheines and others 1994). In keeping with common practice, the business environment obstacles are assumed to cause firm growth, not the other way around, and the model is assumed to contain all common causes of the variables in the model. To be consistent with the fixed effects specification in table 2, demeaned values of the business environment obstacles are used,

FIGURE 1. DAG Analysis of the General Obstacles to Firm Growth



Source: Authors' analysis based on WBES data described in text.

where the country average of each obstacle is subtracted from the corresponding obstacle.

Figure 1 illustrates the application of this algorithm to the full sample. The input to the algorithm is the correlation matrix between firm growth and the 10 demeaned business environment obstacles from the sample of 4,197 firms.<sup>8</sup>

Figure 1 shows that the only business environment obstacles that have a direct effect on firm growth are financing, crime, and policy instability. Financing in turn is directly affected by the taxes and regulation obstacle, which include factors such as taxes and tax administration, and regulations in the areas of business licensing, labor, foreign exchange, environment, fire, and safety. Crime is directly affected by the corruption obstacle, and policy instability is affected by corruption, infrastructure, and anticompetitive behavior.<sup>9</sup> The

8. In addition, the significance level was selected for the tests of conditional independence performed by TETRAD. Because the algorithm performs a complex sequence of statistical tests, each at the given significance level, the significance level is not an indication of error probabilities of the entire procedure. Spirtes, Glymour, and Scheines (2001, p. 116), after exploring several versions of the algorithm on simulated data, conclude that "in order for the method to converge to correct decisions with probability 1, the significance level used in making decisions should decrease as the sample size increases, and the use of higher significance levels may improve performance at small sample sizes." For the results in this article obtained from samples ranging from 2,659–4,197 observations, a significance level of 0.10 was used. At the 5 percent significance level, finance, crime, and policy instability have a direct effect on firm growth, whereas at the 1 percent level only finance and crime have a direct effect on growth.

9. The DAG analysis and the set of causal structures determined by the algorithm are useful for an objective selection of variables, with the heuristic interpretation that if DAG analysis shows that obstacle X causes obstacle Y, then firms' reports of X as an obstacle are also likely to affect the probability that they report Y as an obstacle. For details refer to formal definitions.

dashed double-headed arrows between policy instability and crime, inflation, taxes and regulation, and judicial efficiency indicate that the direction of orientation between policy instability and these variables changes between patterns.

The output also shows that the relations between the obstacles themselves are quite complex and that there are multiple relations in the DAG among the business environment obstacles.<sup>10</sup> Since the main focus of this article is to identify the business environment obstacles with a direct effect on growth, the interactions among the different variables are left for future work. Hence, rather than focusing on the farthest variables in the figure, which are indirectly related to firm growth and are thus likely to have a very diluted impact on firm growth, we focus on the variables with direct effects, which are likely to have the biggest impact on growth. Most important, the DAG analysis also identifies financing, crime, and policy stability as the only variables having direct effects on firm growth, as suggested by specification 11 of table 2. As discussed in section II, the analysis identifies direct effects after conditioning on all subsets of the other variables. This suggests that in regression analysis, financing, crime, and policy instability will always have significant coefficients irrespective of the subsets of other obstacles included in the regression. Thus, these are binding constraints, and policies that relax these constraints can be expected to directly increase firm growth.

#### *Binding Constraints and Firm Size and Level of Development*

This section explores whether these relationships are different for firms of different sizes and at different levels of development. The first three columns of table 3 include specifications that interact the three obstacles with firm size, given by the logarithm of sales. The interaction term with the financing obstacle is positive and significant at the 1 percent level, suggesting that larger firms are less financially constrained, confirming the findings of Beck, Demirgüç-Kunt, and Maksimovic (2005). The interaction terms with policy instability and crime are also positive but not significant. When all the interactions are entered together in specification 4, only the interaction term with the financing obstacle is significant. Thus, although there is also some indication that large firms are also affected less by crime and policy instability, this evidence is much weaker.

The three obstacles are also interacted with dummy variables for country income—upper middle income, lower middle income, and low income. The excluded category is high income. The results indicate that all three obstacles tend to be more constraining for middle-income countries. This finding suggests that middle-income countries, having overcome country-specific

10. In addition to the directed arrows and bidirectional arrows, figure 1 also shows that in some cases common latent causes drive associations between some variables (such as financing and corruption) and that in other cases the direction of orientation is inconsistent: some statistical tests indicate that an edge should be oriented as  $x_1 \rightarrow x_2$ , and other statistical tests indicate that it should be oriented as  $x_1 \leftarrow x_2$ .

TABLE 3. Firm Growth Interaction Effects

Variable	Interaction with firm size				Interaction with country income dummy variables			
	1	2	3	4	1	2	3	4
Constant	0.278*** (0.050)	0.218*** (0.061)	0.225*** (0.058)	0.421*** (0.089)	0.207*** (0.029)	0.177*** (0.039)	0.184*** (0.030)	0.299*** (0.046)
Firm size	-0.004 (0.004)	-0.000 (0.004)	-0.000 (0.004)	-0.009 (0.006)	0.004 (0.002)	0.005* (0.003)	0.004 (0.002)	0.004 (0.002)
Financing	-0.058*** (0.016)			-0.053*** (0.015)	-0.002 (0.013)			-0.004 (0.015)
Financing × Size	0.003*** (0.001)			0.003** (0.001)				
Financing × Upper middle					-0.041* (0.023)			-0.034 (0.022)
Financing × Lower middle					-0.041** (0.019)			-0.027 (0.019)
Financing × Low income					-0.016 (0.019)			-0.019 (0.022)
Policy instability		-0.042** (0.020)		-0.024 (0.019)		0.008 (0.012)		0.014 (0.012)
Policy instability × Size		0.002 (0.001)		0.001 (0.001)				
Policy instability × Upper middle						-0.056*** (0.021)		-0.045** (0.018)
Policy instability × Lower middle						-0.055** (0.024)		-0.043* (0.025)
Policy instability × Low income						0.005 (0.019)		-0.008 (0.017)

Street crime			-0.042*	-0.034 (0.025)			-0.010	-0.014
			(0.024)				(0.014)	(0.014)
Street crime × Size			0.001 (0.001)	0.001 (0.002)				
Street crime × Upper middle							-0.021	-0.010
							(0.026)	(0.025)
Street crime × Lower middle							-0.052**	-0.039
							(0.025)	(0.027)
Street crime × Low income							0.039*	0.044**
							(0.021)	(0.020)
Number of firms	6,235	6,133	5,964	5,778	6,235	6,133	5,964	5,778
Number of countries	79	79	79	78	79	79	79	78
Adjusted $R^2$	0.071	0.074	0.071	0.074	0.070	0.075	0.073	0.075
$F$ -test of interactions				0.0503	0.1184	0.0088	0.0039	0.0022

\*Significant at the 10 percent level; \*\*significant at the 5 percent level; \*\*\*significant at the 1 percent level.

*Note:* Numbers in parentheses are standard errors clustered at the country level. The regression equation estimated is  $\text{firm growth} = \alpha + \beta_1 \times \text{size} + \beta_2 \times \text{financing} + \beta_3 \times \text{policy instability} + \beta_4 \times \text{street crime} + \beta_5 \times \text{financing} \times \text{income dummy variables} + \beta_6 \times \text{financing} \times \text{size} + \beta_7 \times \text{policy instability} \times \text{income dummy variables} + \beta_8 \times \text{policy instability} \times \text{size} + \beta_9 \times \text{street crime} \times \text{income dummy variables} + \beta_{10} \times \text{street crime} \times \text{size}$ . The variables are described as follows: firm growth is the percentage increase in firm sales over the past three years. Firm size is the log of sales. Financing, policy instability, and street crime are general obstacles as indicated in the firm questionnaire. They take values 1–4, where 1 indicates no obstacle and 4 indicates a major obstacle. Income dummy variables are country dummy variables based on the income level of the country. High-income dummy variable takes the value of 1 for countries belonging to the high-income group and 0 otherwise, upper middle-income dummy variable takes the value of 1 for countries belonging to the upper middle-income group and 0 otherwise, lower middle-income dummy variable takes the value of 1 for countries belonging to the lower middle-income group and 0 otherwise, low-income dummy variable takes the value of 1 for low-income group countries and 0 otherwise. In specifications 1–3 in each panel, the obstacle variables and its interactions are included individually. Specification 4 in both panels includes the full model. All regressions are estimated using country-fixed effects with clustered standard errors. Each specification also reports the  $p$ -value of the joint significance test of the interaction terms.

*Source:* Authors' analysis based on WBES data described in text.

institutional obstacles, are now more constrained by a common set of obstacles pertaining to finance, crime, and policy instability. This is consistent with Gelb and others (2007), who find that firms' levels of complaints about different obstacles vary with the income level of the countries. The *F*-tests for the hypotheses that all the entered interactions are jointly equal to 0 are rejected at the 1 percent level of significance for the crime and policy instability obstacles but not for the financing obstacle. This suggests that firms in countries in all income groups are similarly affected by the financing obstacle.

### *Checking for Reverse Causality*

While financing, crime, and policy instability have been identified as first-order constraints, significantly affecting firm growth, it is possible that the relations observed may also be due to reverse causality, with inefficient, slow growing firms blaming the environment for their performance. But while reverse causality is potentially a concern, it does not explain why poorly performing firms would systematically complain most about financing, crime, and policy instability and not about the other obstacles. While there might be a causal relation between poor performance and availability of financing, examined in what follows using instrumental variables, it is harder to posit a causal relation between poor performance and crime and policy instability.

The approach recommended by Carlin, Schaffer, and Seabright (2005) is used to check for reverse causality for the street crime and policy instability obstacles. They compare the coefficients of the fixed effects "within-estimator" and "between-estimator" and test for sign changes, arguing that since reverse causality is more likely to be significant at the firm level, it will cause the within-estimator and the between-estimator to change signs.<sup>11</sup> When the fixed effects model is run using the within-estimator, the obstacle coefficients are negative when entered individually. None of the coefficients are perversely positive, which might have suggested reverse causality. The between-estimator also shows the obstacle coefficients to be negative.

Furthermore, as seen in table 1, some factors such as taxes and regulation are rated as very high obstacles compared with others but do not appear as binding constraints, whereas street crime is not rated very highly (except in Latin America) yet still emerges as a binding constraint. This suggests that firms may complain about many factors when surveyed but controls are needed for country differences and firm heterogeneity to identify the obstacles with the largest association with firm growth.

To assess the robustness of the results, instrumental variable regressions (limited information maximum likelihood estimators) are used to extract the exogenous component of the three obstacles. Two sets of instruments are used

11. Carlin, Schaffer, and Seabright (2005) argue that only in the case of the financing constraint, reverse causality makes the within-coefficient more negative than the true value, thus making this method inapplicable.

for financing, crime, and policy instability. The first is the average value of the obstacles for the industry groups in each country. While it is likely that individual firms may blame the obstacles for their poor performance, it is less likely that all firms in a given country-industry group will engage in such blame shifting. Instrumenting the obstacles with the average obstacle for each industry group in the country isolates the exogenous part of the possibly endogenous obstacle the firm reports, which can be used to predict growth. When the obstacles are considered at the country-industry level of aggregation, causality is likely to run from the average obstacles to individual firms, not vice versa. In addition, country-industry averages also help with potential measurement errors that are largely idiosyncratic to the firm and hence uncorrelated with the average values of the obstacles.<sup>12</sup> The second set of instruments is firm responses to the survey question: Does your firm use international accounting standards? A firm's adoption of international accounting standards is likely to influence its business environment constraints, in particular the financing constraint, but is not necessarily independently linked to firm growth rates.

The analysis is also conducted at the country level, averaging the obstacle variables and firm growth rates across countries and controlling for log GDP per capita rather than for any of the firm-level variables. The instruments for financing and policy instability obstacles are a "Common law" dummy variable, which takes a value of 1 if the country follows common law tradition, and three religion variables, Protestant, Muslim, and Catholic, which represent the percentages of the population that are Protestant, Muslim, or Catholic in each country. The instrument for street crime is the common law dummy variable and the "latitude" of a country's capital city. An extensive literature has identified these institutional variables as good instruments for institutional development, and hence they are not used as explanatory variables in the short-term growth regressions in the second stage.

When country-industry averages of the obstacles are used as instruments, only the financing obstacle is negative and significant (table 4, columns 1–3). The first stage *F*-statistic is large, indicating that the country-industry average of the financing obstacle is a good instrument.<sup>13</sup> While the country-industry averages pass the instruments test for policy instability and street crime, these obstacles are now insignificant in the regression. In addition, when all three obstacles are implemented together, financing is again the only significant constraint (column 4). This reinforces the finding that financing is the most robust of the three binding constraints.

When firms' adoption of international accounting standards is used as an instrument, all three obstacles have a significant negative impact on firm

12. Use of group averages as instruments is a common technique, as used in Fisman and Svensson (2007) and described in Krueger and Angrist (2001).

13. This is further confirmed by the weak identification test statistic (Kleibergen-Paap Wald statistic), which is much larger than the critical value of 16.38

TABLE 4. Robustness Test—Instrumental Variables, Firm-level Regressions

Instrument	Country-industry average of the obstacle variable				Does the firm follow international accounting standards?		
	1	2	3	4	5	6	7
Size	0.002 (0.002)	0.006*** (0.002)	0.004* (0.002)	0.003 (0.002)	-0.004 (0.004)	0.011* (0.006)	-0.005 (0.005)
Financing	-0.066*** (0.025)			-0.067** (0.028)	-0.285*** (0.101)		
Policy instability		-0.045 (0.029)		-0.041 (0.031)		-0.897* (0.499)	
Street crime			-0.011 (0.029)	0.014 (0.032)			-0.529** (0.232)
Number of firms	6,235	6,133	5,964	5,778	5,846	5,747	5,592
<i>First-stage test of excluded instruments</i>							
F-statistic (financing)	382.32 (0.000)			112.13 (0.000)	36.48 (0.000)		
F-statistic (policy instability)		334.57 (0.000)		106.44 (0.000)		4.66 (0.031)	
F-statistic (crime)			351.30 (0.000)	110.22 (0.000)			11.11 (0.001)
Underidentification test—Kleibergen-Paap rk Wald statistic	549.12 (0.000)	405.91 (0.000)	453.67 (0.000)	366.18 (0.000)	35.90 (0.000)	4.54 (0.033)	11.20 (0.001)
Weak instrument robust inference—Anderson Rubin Wald test	7.06 (0.008)	2.41 (0.121)	0.14 (0.704)	3.55 (0.014)	9.43 (0.002)	9.82 (0.002)	9.18 (0.002)

\*Significant at the 10 percent level; \*\*significant at the 5 percent level; \*\*\*significant at the 1 percent level.

*Note:* Two-stage instrumental variable regressions are used. Numbers in parentheses are standard errors clustered at the country level. The first-stage regression equation estimated is financing (or policy instability or street crime) =  $\alpha + \gamma_1 \times$  country-fixed effects +  $\gamma_2 \times$  firm size +  $\gamma_3 \times$  instrument. The second-stage regression equation estimated is firm growth =  $\alpha + \beta_1 \times$  country-fixed effects +  $\beta_2 \times$  firm size +  $\beta_3 \times$  financing (predicted value from first stage) +  $\beta_4 \times$  policy instability (predicted value from first stage) +  $\beta_5 \times$  street crime (predicted value from first stage). In specifications 1–4, the instrument used is the average value of the obstacle across each industry in each country. In specifications 5–7, the instrument used is firm response to the variable, “Does the firm adopt international accounting standards?” The variables are described as follows: firm growth is the percentage increase in firm sales over the past three years. Firm size is the log of sales. Financing, policy instability, and street crime are general obstacles as indicated in the firm questionnaire. They take values 1–4, where 1 indicates no obstacle and 4 indicates a major obstacle.

*Source:* Authors’ analysis based on WBES data described in text.

growth. While the first-stage  $F$ -statistic is significant in each case, it is greater than 10 only for the financing and crime obstacles (Stock and Watson 2003 rule of thumb for good instruments). But the Anderson Rubin Wald test, which is the preferred test for robust inference in the weak instrument case, is rejected in all three cases, suggesting that all three obstacles are individually important in affecting firm growth. Over-identification tests are not reported since the equation is just identified in each case.

Cross-country regressions are also run using historical institutional variables as instruments (table 5). All three obstacle variables are negative and significantly associated with firm growth. While the first-stage  $F$ -tests are significant at least at the 5 percent level in each case, the  $F$ -statistic is less than 10, suggesting that the instruments may be weak. Hence, tests for robust inference under weak identification are considered. The Anderson Rubin Wald test of the null hypothesis that the obstacle coefficient is 0 is rejected in all cases. Confidence intervals for these coefficients are also computed. Following Moreira and Poi (2001) and Mikusheva and Poi (2006), critical values of the likelihood ratio tests are obtained, which yield correct rejection probabilities even when the instruments are weak. The confidence region and the  $p$ -value for the coefficient on the obstacle variable based on the conditional likelihood show that the estimated coefficients belong to the confidence region. The underidentification test (Kleibergen-Paap rk Wald statistic) is rejected in each case, indicating that the equation is identified and that instruments pass the test of instrument relevance. The Hansen  $J$ -statistic of overidentification is never rejected, suggesting that the instruments are valid. After controlling for a number of other country-level variables, including growth rates, inflation, property rights protection, level of financial development, and level of institutional development, the (unreported) results are unchanged.

Overall, with different sets of instruments at the firm and country level, the results suggest that there are exogenous components of the financing, crime, and policy instability obstacles that predict firm growth and that the results are not due to reverse causality. The instrumental variable estimations also show that finance is the most robust of the binding obstacles. It must be noted, however, that it is difficult to find perfect instruments at the level of the firm in cross-country regressions and hence that some caveats regarding the instruments are in order. The country-industry averages of the instruments could potentially be correlated with the error term, so there could be systematic differences in growth rates and firm complaints across country-industry groups that raise reverse causality concerns. On the use of international accounting standards as an instrument, it should be noted that firm-fixed effects could not be used in the absence of panel data, so there is always the risk that a firm's adoption of accounting standards might be correlated with unobservables that affect firm growth. Finally, while the instruments in the country-averages regressions can be considered exogenous since historical institutional variables

TABLE 5. Robustness Test—Instrumental Variables, Firm-Level Regressions, Cross-country Regressions

Instrument	1 Common law dummy variable, three religion dummy variables	2 Common law dummy variable, three religion dummy variables	3 Common law dummy variable, latitude
Constant	2.385** (1.013)	1.122*** (0.344)	1.206*** (0.465)
GDP per capita	-0.091** (0.043)	-0.031* (0.016)	-0.052* (0.029)
Financing	-0.556** (0.255)		
Policy instability		-0.270*** (0.093)	
Street crime			-0.264*** (0.102)
Number of countries	79	79	80
F-statistic	2.71 (0.037)	6.44 (0.000)	6.95 (0.002)
Underidentification test—Kleibergen-Paap rk Wald statistic	11.74 (0.019)	27.86 (0.000)	14.63 (0.001)
Weak instruments robust inference— Anderson Rubin Wald test	3.30 (0.015)	3.30 (0.015)	6.69 (0.002)
Moreira and Poi Conditional Likelihood Ratio test	(-2.264, -0.213) (0.986)	(-0.569, -0.115) (0.921)	(-0.726, -0.085) (0.983)
Overidentification test of all instruments— Hansen J-statistic	0.966 (0.809)	1.227 (0.747)	0.562 (0.453)

\*Significant at the 10 percent level; \*\*significant at the 5 percent level; \*\*\*significant at the 1 percent level.

*Note:* Two-stage instrumental variable regressions are used. Numbers in parentheses are robust standard errors. The first-stage regression equation estimated is financing (or policy instability or street crime) averaged across countries =  $\alpha + \gamma_1 \times$  common law dummy variable +  $\gamma_2 \times$  latitude +  $\gamma_3 \times$  Protestant +  $\gamma_4 \times$  Catholic +  $\gamma_5 \times$  Muslim +  $\gamma_6 \times$  GDP per capita +  $\varepsilon$ . The second-stage regression equation estimated is firm growth =  $\alpha + \beta_1 \times$  GDP per capita +  $\beta_2 \times$  financing (predicted value from first stage) +  $\beta_3 \times$  policy instability (predicted value from first stage) +  $\beta_4 \times$  street crime (predicted value from first stage). The variables are described as follows: firm growth is the percentage increase in firm sales over the past three years. GDP per capita is the log of real GDP per capita in U.S. dollars. Financing, policy instability, and street crime are general obstacles as indicated in the firm questionnaire. They take values 1–4, where 1 indicates no obstacle and 4 indicates a major obstacle. English Common law is a dummy variable that takes the value of 1 for common law countries. Latitude is the absolute value of the latitude of the country scaled between 0 and 1. Protestant, Catholic, and Muslim variables are the percentage of Protestant, Catholic, and Muslim religions in each country from La Porta and others (1997). “Does the firm adopt international accounting standards?” is a dummy variable that takes the value of 1 if the firm adopts international accounting standards and 0 otherwise.

*Source:* Authors’ analysis based on WBES data described in text.

are being used, there is the possibility of omitted-variable bias in the absence of country-fixed effects.

#### *Other Robustness Checks*

This section describes several robustness checks of the main findings. First is an investigation of whether the results are driven by a few countries or firms. Chandra and others (2001) suggest that firms in African countries may exhibit different responses than the other firms in the sample. A report by the United States General Accounting Office (2004) analyzes several firm-level surveys on Africa, including the WBES, and concludes that perceptions of corruption levels vary greatly for African countries, presenting a challenge for broad-based U.S. anticorruption programs. Ayyagari, Demirgüç-Kunt, and Maksimovic (2008) argue that transition economies are fundamentally different from others in their perceptions of protection of property rights.

The first four columns of table 6 present the results for preferred specification on different samples after eliminating transition and African economies. While financing and crime remain binding constraints, policy instability loses significance when these countries are dropped from the sample. These results suggest that the type of policy instability present in transition and African economies is particularly damaging to firm expansion.

High inflation rates may be responsible for the very high firm growth rates observed in some countries, particularly in Bosnia and Herzegovina, Estonia, and Uzbekistan. Constructing real firm growth rates and replicating all the analyses in this article do not change the main results, however.

To check whether the results are driven by specific outlier firms, firms with very high growth rates (higher than 100 percent) are eliminated. Firms reporting very high growth rates are typically from transition and African economies, where political connections could be behind the high growth rates and firms thus may not be affected by business environment obstacles. The experience of these firms may therefore differ from that of the typical firm. In the reduced sample, financing remains the most binding constraint to firm growth, confirming that the results are not driven by the fastest growing firms in the sample. The impact of crime on firm growth is less robust to eliminating high growth rate firms, however.

It is also possible that young firms are affected differently by business environment obstacles. Excluding all firms younger than five years old from the sample leaves the financing result unchanged, while crime and policy instability are not significant in the regressions (results not reported). This suggests that ensuring policy stability and controlling crime are particularly important to the growth of younger firms. Financing is still the main binding constraint to growth when robust regression analysis or quintile regressions are used to control for the presence of possible influential outliers.

Several other robustness checks of the main findings were also conducted (results are available on request). First, the variation at the firm level and the

TABLE 6. Robustness Test—Varying Samples

Variable	High-growth firms included, countries excluded				High-growth firms excluded, countries excluded				
	Transition economies	African economies	African and transition economies	Uzbekistan, Bosnia and Herzegovina, Estonia	None	Transition economies	African economies	African and transition economies	Uzbekistan, Bosnia and Herzegovina, Estonia
	1	2	3	4	5	6	7	8	9
Constant	0.227*** (0.045)	0.307*** (0.045)	0.233*** (0.045)	0.226*** (0.041)	0.172*** (0.028)	0.225*** (0.039)	0.175*** (0.029)	0.236*** (0.042)	0.165*** (0.028)
Firm size	-0.000 (0.002)	0.005 (0.003)	0.000 (0.002)	0.004 (0.003)	0.003 (0.002)	0.001 (0.002)	0.003 (0.002)	0.000 (0.002)	0.003 (0.002)
Financing	-0.012* (0.006)	-0.033*** (0.008)	-0.020*** (0.007)	-0.019*** (0.007)	-0.018*** (0.005)	-0.017*** (0.006)	-0.020*** (0.005)	-0.022*** (0.006)	-0.016*** (0.005)
Policy instability	-0.007 (0.008)	-0.015* (0.009)	-0.010 (0.008)	-0.008 (0.008)	-0.015*** (0.005)	-0.011 (0.007)	-0.015** (0.006)	-0.010 (0.008)	-0.014*** (0.005)
Street crime	-0.016** (0.007)	-0.027*** (0.008)	-0.020*** (0.007)	-0.021*** (0.007)	-0.007 (0.005)	-0.018*** (0.006)	-0.008 (0.005)	-0.020*** (0.007)	-0.009* (0.005)
Number of firms	3,224	5,236	2,682	5,534	5,631	3,202	5,107	2,678	5,421
Number of countries	54	62	38	75	78	54	62	38	75
Adjusted R <sup>2</sup>	0.073	0.072	0.056	0.053	0.086	0.074	0.082	0.068	0.084

\*Significant at the 10 percent level; \*\*significant at the 5 percent level; \*\*\*significant at the 1 percent level.

*Note:* Numbers in parentheses are standard errors clustered at the country level. The regression equation estimated is firm growth =  $\alpha + \beta_1 \times \text{GDP per capita} + \beta_2 \times \text{size} + \beta_3 \times \text{financing} + \beta_4 \times \text{policy instability} + \beta_5 \times \text{street crime}$ . The variables are described as follows: firm growth is the percentage increase in firm sales over the past three years. GDP per capita is the log of real GDP per capita in U.S. dollars. Firm size is the log of firm sales. Financing, policy instability, and street crime are general obstacles as indicated in the firm questionnaire. They take values 1–4, where 1 indicates no obstacle and 4 indicates a major obstacle. Specifications 1–4 exclude certain countries from the full sample of firms, while specifications 5–9 exclude the countries from a reduced sample that does not include firms reporting very high (or very low) growth rates ( $> \pm 100$  percent). All regressions are estimated using country-fixed effects with clustered standard errors.

*Source:* Authors' analysis based on WBES data described in text.

variation at the country level were separated—that is, both the individual firm-level effect of the obstacle (the demeaned value of the obstacle, or obstacle minus the country average of the obstacle) and the cross-country effect (the country average of the obstacle) are included. Once again, in the full specification with the firm-level and country-level effects of all the 10 business environment obstacles included, the only individual firm-level obstacles that are binding constraints to growth are financing, policy instability, and crime.

Next, various tests were performed to detect outliers and influential points. DFBETA statistics were computed for each obstacle variable. The DFBETAs for regressor  $i$  measure the distance that this regression coefficient shifts when the  $j$ th observation is included or excluded from the regression, scaled by the estimated standard errors of the coefficient. None of the obstacles in the regressions have  $|DFBETA| > 1$  or the even the stricter cutoff of  $|DFBETA| > 2\sqrt{(N)}$ , as suggested by Besley, Kuh, and Welsch (1980). This implies that the results are not driven by influential observations. Financing and crime have a significant negative effect on firm growth, while policy instability is insignificant.<sup>14</sup>

The observed association between obstacles and firm growth might occur because firms that face higher obstacles are also those that face limited growth opportunities. After controlling for growth opportunities using average industry growth or firm-level dependence on external finance, the results remain unchanged using either measure of growth opportunities. Financing, policy instability, and street crime are significant when entered individually, and only financing and street crime are significant when entered together.

Also investigated is whether firm ownership drives the results. The sample includes 203 firms with government ownership. Excluding these firms leaves the financing and crime results unchanged. The sample also includes 1,340 firms with more than 50 percent foreign ownership. When these foreign firms are excluded from the analysis, only the financing obstacle remains significant. This suggests that foreign-owned firms are particularly sensitive to policy instability and crime. Including dummy variables to control for government and foreign ownership also leads to similar results, in that only financing and crime are significant.

Finally, the results are checked for robustness subject to controlling for perception biases. Following Kaufmann and Wei (1999), two kvetch variables were constructed, Kvetch1 and Kvetch2, which are deviations of each firm's response from the mean country response to two general survey questions.

14. The DFITS statistic of Welsch and Kuh (1977), which identifies the influence of each observation on the fitted model, was also computed (unreported results). Besley, Kuh, and Welsch (1980) suggest that a cutoff of  $|DFITS| > 2\sqrt{(k/N)}$  indicates influential observations, where  $k$  is the number of estimated coefficients and  $N$  is the number of observations. There are 145 observations in the current sample with  $|DFITS|$  greater than the cutoff value. When these influential observations are dropped, the financing, policy instability, and crime obstacles are all negative and significant.

Kvetch1 uses the responses to the question: How helpful do you find the central government today towards businesses like yours? Kvetch2 is constructed using the responses to the question: How predictable are changes in economic and financial policies? Since higher values correspond to unfavorable responses, positive deviations from the country mean indicate pessimism, and negative deviations indicate optimism. Controlling for differences in perceptions using the kvetch variables leaves only financing and crime results unchanged. Policy instability remains insignificant.

### *Individual Financing Obstacles*

The results indicate that financing is one of the most important obstacles that directly constrain firm growth. To get a better understanding of what type of financing obstacles are constraining firm growth, entrepreneurs were asked to rate the extent to which the following financing factors represent an obstacle to their growth: collateral requirements, paperwork and bureaucracy, high interest rates, need for special connections, banks lacking money to lend, access to foreign banks, access to nonbank equity, access to export finance, access to financing for leasing equipment, inadequate credit and financial information on customers, and access to long-term loans. The ratings are again on a scale of 1 to 4, increasing with the severity of obstacles.

Table 7 reports regressions that parallel those in table 2, but focusing on specific financing obstacles. A residual is also included for the component of the general financing obstacle not explained by the individual obstacles. The results indicate that not all financing obstacles reported by firms are constraining. Only the coefficients of collateral, paperwork, high interest rates, special connections, banks' lack of money to lend, lease finance, and the residual are significant when entered individually. High interest rates have the highest economic impact—a one-standard deviation increase in the obstacle results in a 3.3 percent decrease in firm growth.

Unlike the obstacles examined previously, specific financing obstacles are highly correlated with each other. Specification 13 includes all obstacles that are significant when entered individually. Only the high interest rates coefficient is significant and only at the 10 percent level. If the residual is also included, as in specification 14, only the residual remains significant. The residual is likely to summarize how different firms are affected differently by the structure and ownership of the financial system, the level of competition, and other factors that are not fully captured by the specific financial obstacles, thus proxying for general access to credit.<sup>15</sup>

Looking at the correlations among obstacles using DAG analysis shows that high interest rates are the only financial obstacle directly constraining firm growth. (It may be noted that while the direction of causation is restricted to go

15. The residual remains significant if all the general obstacles are included in addition to the residual and the significant individual financing obstacles.

TABLE 7. Impact of Individual Financing Obstacles on Firm Growth

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Constant	0.180*** (0.031)	0.172*** (0.029)	0.211*** (0.033)	0.132*** (0.030)	0.166*** (0.034)	0.158*** (0.028)	0.129*** (0.040)	0.129*** (0.039)	0.106*** (0.034)	0.122*** (0.036)	0.121*** (0.039)	0.094*** (0.032)	0.264*** (0.040)	0.212*** (0.048)
Firm size	0.003 (0.003)	0.004 (0.002)	0.004 (0.003)	0.005 (0.003)	0.004 (0.003)	0.004 (0.003)	0.004 (0.003)	0.005 (0.003)	0.005* (0.003)	0.004 (0.003)	0.005* (0.003)	0.006* (0.003)	0.002 (0.003)	0.005 (0.003)
Collateral	-0.023*** (0.007)												-0.006 (0.010)	-0.008 (0.011)
Paperwork		-0.025*** (0.009)											-0.010 (0.010)	-0.015 (0.011)
High interest rates			-0.032*** (0.010)										-0.020* (0.011)	-0.011 (0.012)
Special connections				-0.015** (0.007)									-0.001 (0.010)	-0.002 (0.014)
Lack money to lend					-0.024*** (0.008)								-0.011 (0.009)	-0.007 (0.012)
Lease finance						-0.015 (0.009)								
Access to foreign banks							-0.002 (0.007)							
Access to nonbank equity								-0.005 (0.008)						
Export finance									0.004 (0.009)					
Credit										0.003 (0.007)				
Long-term loans											-0.008 (0.008)			
Financing residual												-0.022** (0.011)		-0.023** (0.011)

(Continued)

TABLE 7. Continued

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Number of firms	6,024	6,133	6,298	6,002	5,808	5,076	5,093	5,037	4,440	5,332	5,030	2,988	5,317	2,988
Number of countries	79	79	79	79	79	78	78	78	78	78	60	58	79	58
Adjusted R <sup>2</sup>	0.070	0.069	0.070	0.064	0.074	0.070	0.065	0.070	0.071	0.072	0.068	0.006	0.071	0.065

\*Significant at the 10 percent level; \*\*significant at the 5 percent level; \*\*\*significant at the 1 percent level.

*Note:* Numbers in parentheses are standard errors clustered at the country level. The regression equation estimated is  $\text{firm growth} = \alpha + \beta_1 \times \text{size} + \beta_2 \times \text{collateral} + \beta_3 \times \text{paperwork} + \beta_4 \times \text{high interest rates} + \beta_5 \times \text{special connections} + \beta_6 \times \text{lack money to lend} + \beta_7 \times \text{access to foreign banks} + \beta_8 \times \text{access to nonbank equity} + \beta_9 \times \text{export finance} + \beta_{10} \times \text{lease finance} + \beta_{11} \times \text{credit} + \beta_{12} \times \text{long-term loans} + \beta_{13}$  (residual). The variables are described as follows: firm growth is the percentage increase in firm sales over the past three years. Firm size is the log of sales. Collateral, paperwork, high interest rates, special connections, lack money to lend, access to foreign banks, access to nonbank equity, export finance, lease finance, credit, and long-term loans are individual financing obstacles as indicated in the firm questionnaire. They take values of 1–4, where 1 indicates no obstacle and 4 indicates a major obstacle. In specifications 1–11, each of the obstacle variables is included individually. Residual is the residual from a regression of the general financing obstacle on all the individual financing obstacles. Specification 13 includes collateral, paperwork, high interest rates, special connections, lack of money to lend, and lease finance. Specifications 12–14 include the financing residual. All regressions are estimated using country-fixed effects with clustered standard errors.

*Source:* Authors' analysis based on WBES data described in text.

from the financing obstacles to growth, no ordering is imposed among the individual financing obstacles.) That finding is not surprising since the high interest rate obstacle captures the cost of financing and is itself an endogenous variable that depends on the ability of the financial system to satisfy the demand for capital. It can be expected to constrain all firms in all countries. Collectively, specific financing obstacles still do not capture everything measured by the general financing obstacle, as illustrated by the effect of the residual. This also suggests that the general access to credit is an important constraint for firms.

The DAG analysis also suggests that perceptions of high collateral requirements and paperwork influence the perceptions of high interest rates. High interest rates also influence perceptions of lack of access to lease finance, banks lacking money to lend, and the need for special connections in banking. Regressions of the high interest rate obstacle on individual financing obstacles found specific financing obstacles all to be individually correlated with high interest rates. When all financing obstacles are considered together, only collateral, paperwork, special connections, lack of money to lend, and access to long-term loans are correlated with high interest rates, as in the DAG analysis.

#### IV. CONCLUSION AND POLICY IMPLICATIONS

Although firms report many obstacles to their growth, not all of them are equally constraining. Some may affect firm growth only indirectly, through their influence on other factors, or not at all. Analyses using regressions and DAG methodology found only finance, crime, and policy instability to be binding constraints, with a direct association with the growth rate of firms. Thus, while the other obstacles studied in this article are also associated with firm growth through their impact on each other and on the direct obstacles, maintaining policy stability, keeping crime under control, and undertaking financial sector reforms to relax financing constraints are likely to be the most effective means of promoting firm growth. The financing obstacle's impact on growth is robust to varying samples of countries, while the policy instability and crime results are less robust to the exclusion of transition and African economies, where they might be the most problematic for business growth. The results were subject to a battery of robustness tests, including changing the sample and controlling for reverse causality, growth opportunities, and potential perception biases in survey responses. The financing obstacle was the most robust to all these tests. This was further confirmed through instrumental variable regressions. This suggests that financial sector reform should be a priority for governments contemplating reform of their business environments.<sup>16</sup>

Further investigation of the financing obstacles revealed the importance of high interest rates in constraining firm growth. This result highlights the

16. An implicit assumption with the use of any survey data is that firm managers are knowledgeable about the different obstacles and understand the true workings of the financial and legal systems.

importance of macroeconomic policies in influencing growth at the firm level, as indicated by the correlation between high interest rates and banks' lack of money to lend. High interest rates are also correlated with high collateral and paperwork requirements, the need for special connections with banks, and the unavailability of long-term loans. These results suggest that bureaucracy and corruption in banking, greater collateral requirements, and lack of long-term loans are common in high-interest-rate environments. In addition to the cost of financing, general access to credit is an important constraint to firm growth. Country- and firm-level determinants of financing obstacles would benefit from further investigation.

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## APPENDIX

TABLE A-1. General Obstacles

Country	Firm growth	Number of firms	General obstacles									
			Financing	Policy instability	Inflation	Exchange rate	Judicial efficiency	Street crime	Corruption	Taxes and regulation	Anticompetitive behavior	Infrastructure
Albania	0.22	103	3.04	3.48	2.75	2.61	2.69	3.42	3.34	3.15	2.72	3
Argentina	0.08	82	3.01	3.07	1.77	1.73	2.27	2.39	2.58	3.34	2.41	1.93
Armenia	-0.2	96	2.45	2.87	2.73	2.69	1.5	1.85	1.96	3.39	1.9	1.77
Azerbaijan	-0.2	70	3.11	2.55	2.9	2.61	2.59	2.39	3	3.17	2.96	2.43
Bangladesh	0.13	34	2.6	3.08	2.86	3.09	2.38	3.07	3.61	3.03	2.4	
Belarus	0.1	97	3.33	2.95	3.63	3.16	1.55	2.17	1.88	3.34	1.99	1.7
Belize	0.12	26	2.81	2.38	2.04	1.73	1.56	2.12	1.96	2.77	1.96	2.19
Bolivia	0.04	80	3.03	3.1	2.58	2.46	2.78	2.76	3.56	3.15	2.71	2.63
Bosnia and Herzegovina	0.63	76	3.09	3.19	1.33	1.25	2.54	1.86	2.56	3.16	2.58	2.65
Botswana	0.32	72	2.24	1.55	1.93	1.33		1.88	1.65	1.89		2.16
Brazil	0.03	148	2.67	3.53	2.8	2.94	2.56	2.83	2.53	3.66	2.49	2.18
Bulgaria	0.15	101	3.16	3.03	2.76	2.37	2.26	2.64	2.64	3.1	2.34	2.23
Cambodia	0.07	298	2.04	2.9	2.61	2.32	2	3.29		2.23	2.21	2.33
Cameroon	0.12	44	3.14	2.03	2.03	2.28		2.94	3.36	2.7		3.44
Canada	0.17	74	2.1	2.18	2.15	2.16	1.47	1.32	1.4	2.59	1.62	1.41
Chile	0.09	81	2.36	2.58	2.16	2.59	1.97	2.4	1.86	2.36	1.91	1.86
China	0.05	70	3.36	2.1	2.23	1.83	1.5	1.83	1.94	2.03	2.13	1.89
Colombia	0.06	83	2.67	3.49	3.01	3.34	2.4	3.37	2.87	3.17	2.33	2.46
Costa Rica	0.25	81	2.62	2.67	2.93	2.75	2.2	2.89	2.52	2.8	2.44	2.63
Cote d'Ivoire	0.05	47	2.78	2.85	2.37	1.97		3.29	3.24	2.49		2.29
Croatia	0.1	97	3.26	3.11	2.47	2.86	2.74	2.09	2.59	3.34	2.04	1.94

(Continued)

TABLE A-1. Continued

Country	Firm growth	Number of firms	General obstacles									
			Financing	Policy instability	Inflation	Exchange rate	Judicial efficiency	Street crime	Corruption	Taxes and regulation	Anticompetitive behavior	Infrastructure
Czech Republic	0.1	80	3.18	2.95	3	2.46	2.18	2.09	2.1	3.44	2.16	2.5
Dominican Republic	0.21	95	2.63	3.02	2.85	2.88	2.43	3.22	3	3.96	2.75	2.63
Ecuador	-0.06	74	3.27	3.6	3.76	3.78	3.04	3.49	3.53	3.07	2.55	2.67
Egypt, Arab Republic	0.16	44	2.91	3.14	2.68	2.9		2.24	3.14	3.43		3.23
El Salvador	-0.02	73	2.93	2.97	3.16	2.55	2.65	3.67	3.06	2.93	2.36	2.52
Estonia	0.63	109	2.47	2.62	2.41	1.89	1.72	2.09	1.88	2.67	1.85	1.64
Ethiopia	0.26	70	3.02	2.38	2.26	2.47		1.51	2.46	2.33		3.04
France	0.2	62	2.61	2.2	2.03	1.82	1.79	1.77	1.62	3.13	2.02	1.81
Georgia	0.14	78	3.29	2.84	3.29	2.94	1.86	2.32	3.04	3.22	2.18	2.14
Germany	0.11	60	2.59	1.63	1.87	1.64	2.12	1.56	1.88	3.17	2.3	1.71
Ghana	0.19	58	3.1	2.37	3.43	2.58		2.37	2.78	2.83		2.74
Guatemala	0.18	84	2.99	3.16	3.32	3.6	2.5	3.22	2.7	2.75	2.28	2.52
Haiti	0	62	3.28	3.18	2.92	2.9	2.35	3.81	3.08	2.73	3.1	3.89
Honduras	0.1	65	2.97	2.53	3.41	3.3	2.41	3.23	2.9	2.83	2.79	2.56
Hungary	0.28	98	2.6	2.61	2.59	1.6	1.32	1.76	1.95	3.01	2.14	1.53
India	0.15	152	2.59	2.81	2.77	2.42	2.02	1.98	2.8	2.43		2.8
Indonesia	-0.05	70	2.83	3.14	3.21	3.4	2.26	2.69	2.69	2.59	2.96	2.37
Italy	0.16	64	1.97	2.97	2.23	1.83	2.22	2.22	1.76	3.25	2.19	2.24
Kazakhstan	0.1	89	3.29	2.88	3.62	3.48	2.08	2.6	2.7	3.37	2.55	2.1
Kenya	0.03	70	2.76	3.03	2.8	1.75		3.27	3.56	2.53		3.64
Kyrgyz Republic	0	68	3.47	3.23	3.78	3.48	2.13	3.26	3.19	3.59	3	1.98
Lithuania	0.08	68	3.03	2.27	2.3	1.91	2.25	2.52	2.44	3.26	2.31	1.82
Madagascar	0.16	67	3.08	2.67	3.32	2.3		2.79	3.44	2.75		3.03

Malawi	0.64	30	2.81	2.2	3.56	2.54		3.08	2.65	2.37		3.76
Malaysia	0.01	37	2.57	2.14	2.44	1.94	1.63	1.78	2	2.03	1.91	1.92
Mexico	0.24	71	3.24	3.27	3.48	3.13	2.77	3.37	3.31	3.21	2.75	2.23
Moldova	-0.15	84	3.42	3.6	3.86	3.51	2.51	3.11	2.93	3.58	2.93	2.64
Namibia	0.3	52	2	1.66	2.08	2.08		1.96	1.71	1.98		1.63
Nicaragua	0.21	76	3.05	2.91	3.39	3.07	2.33	2.8	2.88	2.96	2.42	2.71
Nigeria	0.26	63	3.11	3.43	3.21	2.92		3.3	3.37	3.1		3.68
Pakistan	0.05	61	3.28	3.64	3.21	2.87	2.56	3.03	3.54	3.2	2.67	3.08
Panama	0.09	81	2.06	2.72	2.04	1.42	2.4	2.98	2.8	2.38	2.44	2.19
Peru	-0.02	83	3.09	3.21	2.85	2.99	2.55	2.81	2.83	3.35	2.68	2.27
Philippines	0.07	84	2.69	2.85	3.36	3.43	2.24	2.8	3.13	3.08	2.9	2.88
Poland	0.33	175	2.47	2.75	2.58	2.27	2.3	2.37	2.27	3.08	2.23	1.67
Portugal	0.12	52	1.8	2.08	2.1	1.74	1.88	1.64	1.73	2.15	2.18	1.75
Romania	0.07	96	3.26	3.44	3.75	3.19	2.59	2.45	2.88	3.57	2.52	2.44
Russian Federation	0.29	384	3.2	3.49	3.53	3.15	2.17	2.65	2.62	3.58	2.67	2.12
Senegal	0.15	38	3	2.21	2.56	2		2.61	3.04	2.97		2.88
Singapore	0.12	74	1.97	1.5	1.61	1.88	1.32	1.22	1.28	1.55	1.58	1.42
Slovak Republic	0.14	91	3.34	1.53	3.13	2.43	2.13	2.49	2.47	3.25	2.26	1.98
Slovenia	0.29	101	2.3	2.6	2.23	2.21	2.29	1.68	1.64	2.91	2.43	1.74
South Africa	0.26	87	2.34	1.97	2.45	2.39		3.58	2.58	2.64		1.83
Spain	0.25	66	2.21	2.17	2.27	1.93	1.97	1.92	2.08	2.65	2.25	1.94
Sweden	0.23	73	1.83	2.46	1.66	1.78	1.46	1.54	1.18	2.67	1.97	1.52
Tanzania	0.25	40	2.85	2.48	2.65	2.07		1.96	2.88	2.7		3.21
Thailand	-0.02	337	3.1	3.49	3.4	3.62	2.13	3.48	3.47	3.54	3.6	2.76
Trinidad and Tobago	0.18	80	3.03	1.81	2.49	2.41	1.45	2.18	1.68	2.78	1.79	2.1
Tunisia	0.14	41	1.79	1.94	1.7	1.94		1.55	2.11	2.12		2.1
Turkey	0.1	115	3.12	3.55	3.61	2.83	2.3	2.09	2.89	3.16	2.79	2.22
Uganda	0.18	67	3.17	2.47	2.68	1.78		2.27	2.93	2.48		2.81
Ukraine	0.03	170	3.45	3.22	3.43	3.05	2.16	2.49	2.51	3.7	2.86	2.22

(Continued)

TABLE A-1. Continued

Country	Firm growth	Number of firms	General obstacles									
			Financing	Policy instability	Inflation	Exchange rate	Judicial efficiency	Street crime	Corruption	Taxes and regulation	Anticompetitive behavior	Infrastructure
United Kingdom	0.27	62	2.33	2.19	2.16	2.28	1.5	1.95	1.24	2.87	1.72	1.69
United States	0.16	66	2.38	2.05	2.12	1.71	1.84	2.14	1.88	2.39	1.7	1.83
Uruguay	0	72	2.73	2.61	2.03	2.39	1.91	2.07	2	3.21	1.71	1.9
Uzbekistan	0.64	94	2.77	2.03	3.04	2.6	1.68	1.77	2.22	2.66	2.28	1.95
Venezuela	-0.02	78	2.62	3.64	3.48	3.12	2.65	3.18	3	3.1	2.63	2.31
Zambia	0.18	46	2.95	2.57	3.45	1.88		3.18	2.78	2.39		3.07
Zimbabwe	0.47	91	3.05	2.73	3.83	2.93		2.57	2.87	2.87		2.53
Average	0.15	86.73	2.8	2.72	2.76	2.49	2.15	2.51	2.56	2.9	2.37	2.34

*Note:* The variables are described as follows: firm growth is the percentage change in firm sales over the past three years (1996–99). Financing, policy instability, inflation, exchange rate, judicial efficiency, street crime, corruption, taxes and regulation, anticompetitive behavior, and infrastructure are general obstacles as indicated in the firm questionnaire. They take values 1–4, where 1 indicates no obstacle and 4 indicates a major obstacle. Firm obstacles are averaged over all firms in each country. The number of firms reported is the number of firms with nonmissing firm growth rates.

*Source:* Authors' analysis based on WBES data described in text.

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# The Unbanked: Evidence from Indonesia

*Don Johnston Jr. and Jonathan Morduch*

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To analyze the prospects for expanding financial access to the poor, bank professionals assessed 1,438 households in six provinces in Indonesia to judge their creditworthiness. About 40 percent of poor households were judged creditworthy according to the criteria of Indonesia's largest microfinance bank, but fewer than 10 percent had recently borrowed from a microbank or formal lender. Possessing collateral appeared as a minor determinant of creditworthiness, in keeping with microfinance innovations. Although these households were judged able to service loans reliably, most desired small loans. Calculations show that the bank, given its current fee structure and banking practices, would lose money when lending at the scales desired. So, while innovations have helped to extend financial access, it remains difficult to lend in small amounts and cover costs. JEL codes: G21, O16

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Microfinance is built on a compelling logic: hundreds of millions of poor and very poor households seek capital to build small businesses, but their lack of collateral restricts access to loans. Innovative “microbanks” meet the demand with more flexible collateral requirements and thus unleash untapped productive power.<sup>1</sup> The narrative, highlighted by the Nobel Peace Prize committee in awarding the 2006 prize to Muhammad Yunus and the Grameen Bank of Bangladesh, has driven the global expansion of microfinance (Counts 2008).

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1. The Microcredit Summit's annual survey counted 133 million customers worldwide at the end of 2006, and an aim is to reach 175 million by 2015 (Daley-Harris 2007). The measure of the potential market has been hard to pin down. Elizabeth Littlefield, the CEO of the main donor consortium on microfinance, the Consultative Group to Assist the Poor, writes that “as many as 3 billion people still lack access to basic financial services,” a figure subsequently cited in U.N. and World Bank publications (Littlefield 2006, p. vi).

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The notion of millions of unbanked households accords with evidence of most formal banks' shallow outreach to the poor (World Bank 2007; Armendáriz and Morduch 2005). But a lack of use does not imply a lack of access. Some among the "unbanked" may be excluded despite having worthy uses for capital. Others may simply not be creditworthy. And others may be creditworthy but not interested in taking on debt.

The proportions matter. Yunus's activist vision stresses the first group, suggesting that the unbanked are largely thwarted entrepreneurs. Their lack of financial access hinders their attempts to exit poverty through investment and hard work. According to Yunus (2008, p. 3), the key features of microcredit (the term he prefers) include the idea that the loans are designed "to help the poor families to help themselves to overcome poverty." Further, "it is not based on any collateral, or legally enforceable contracts. It is based on 'trust,' not on legal procedures and system." And specifically, "it is offered for creating self-employment for income-generating activities and housing for the poor, as opposed to consumption." In confronting conventional banking practices, Yunus continues that microcredit "was initiated as a challenge to the conventional banking which rejected the poor by classifying them to be 'not creditworthy.' As a result it rejected the basic methodology of the conventional banking and created its own methodology" Yunus (2008, p. 3).

Those who believe that other interventions may have bigger impacts on the poor than access to finance stress the second and third groups among the unbanked (those deemed not creditworthy or those not interested in being in debt), arguing that the net impacts of microfinance are apt to be smaller than advocates assert (Robinson 2001; Hulme and Mosley 1996). For these critics the poorest households need grants and social protection programs rather than loans, while for Yunus (2008, p. 3) credit remains a "human right" to be guaranteed for a broad swath of the very poor.<sup>2</sup>

Typical household data sets do not offer much insight into households' potential to benefit from financial access. Gauging creditworthiness, for example, typically requires an on-site professional assessment of unbanked households, a task well beyond the competence of typical survey teams. Yunus is also right in arguing that creditworthiness is in part a function of the lending technology. Someone not creditworthy in the eyes of a bank, for example, may be an excellent customer of a microfinance institution. So, the fundamental debates persist.

This article examines data from Indonesia, an important early site for microfinance (Patten and Rosengard 1991). The survey covers 1,438 Indonesian households in six provinces in fall 2002. The authors participated in the survey

2. The definitions of "very poor" and "poorest" are not always precise. The Microcredit Summit organization uses a clear definition: households living on less than \$1 a person a day at international prices or living on incomes that put them in the lower half of the poor population (Daley-Harris 2007). The sample of poor households here includes many who would be very poor according to the second element of the definition.

and sample design, and assisted in supervising data entry, together with staff from Bank Rakyat Indonesia (BRI), a state-owned bank whose microfinance unit has wide reach in rural areas and has been operating in its current form for nearly 25 years (Patten, Rosengard, and Johnston 2001; Robinson 2001). The sample frame is a randomized stratified sample drawn without reference to BRI's customer base.

The authors took advantage of the enumerators' professional expertise by assessing the creditworthiness of all households in the survey, whether or not they were borrowing or even interested in borrowing. Households were judged for their hypothetical feasibility for taking loans from BRI's microfinance unit.<sup>3</sup> The data thus offer a unique chance to assess the creditworthiness of slices of the general population using procedures applied by a long-established microfinance bank. The results show that although fewer than 10 percent of the poor have borrowed recently from a microfinance or formal sector bank (BRI's microfinance unit or another), nearly 40 percent are creditworthy according to BRI's standards for microlending. The finding supports Yunus's view that many of the unbanked are creditworthy in the light of microfinance practice, though the figure is well short of 100 percent.

BRI's lending methods and microfinance products compel particular interest since they have proven to be deliverable profitably and on a wide scale to low-income populations throughout Indonesia. Yaron, Benjamin, and Charitonenko (1998, p. 164) calculate that if BRI's microfinance unit functioned as an independent bank, it would have earned returns "well above those in the banking industry." Pretax returns to assets for the microfinance unit were 6.1 percent in 1995, twice that for many well performing commercial banks. In an unexpected twist, BRI's microfinance operation has turned out to cross-subsidize BRI's other divisions, all serving much wealthier customers (p. 167).

Households not deemed creditworthy by BRI's standards may prove to be good customers of banks and other lending institutions (cooperatives and non-governmental organizations, for example) using alternative methods and a higher dose of subsidy. But a large unserved poor population is deemed creditworthy, even using BRI's relatively conservative criteria.

BRI's microfinance unit, unlike Grameen Bank, requires that borrowers pledge collateral but, like other microlenders, approaches collateral far more flexibly than do conventional banks. In keeping with this practice, the lack of collateral was cited as a deterrent by only about 10 percent of the households that are creditworthy but not borrowing from banks. Regression analyses of

3. BRI is a large full-service bank. Its microfinance unit is a subsidiary, based on small sub-branches located in towns, mainly in rural Indonesia. References here to BRI pertain to the BRI microfinance unit. As explained below, the creditworthiness questions focused on eligibility for borrowing using BRI's general microfinance loan product, Kupedes. A recent global microfinance survey finds that BRI's microfinance unit ranked fifth in the world in numbers of borrowers, first in numbers of savers, and first in portfolio size (MIX 2008).

the professional assessments of the enumerators concur. BRI's insight, as with most microlenders (but in contrast to most banks), has been to find better ways to lend against future household income flows, rather than to require that loans be fully secured by seizable assets of equal or greater value to loans. Collateral thus is more limited in determining creditworthiness here relative to traditional banking approaches.<sup>4</sup>

While some evidence aligns broadly with Yunus's vision, other evidence departs from it. First, financing small businesses is the most common use of loan funds, but about half the volume of borrowing by poor households in the survey is for nonbusiness purposes, including consumption. Important non-business uses include paying for school fees, medical treatment, home repair or expansion, daily consumption, and social and holiday expenses. The finding holds for low-income households below regional poverty lines, just above the lines, and well above the lines. Despite the emphasis on "microcredit for micro-enterprise" by donors and leaders like Yunus, consumption credit appears as an important need of poor populations, not as a minor concern.

Second, transacting small loans remains challenging. Regression analyses, accounting data from BRI, and survey questions on actual and desired loan sizes show that most unbanked individuals in the sample seek loans too small to be profitable at the going interest rate, even for an innovative microlender like BRI. The evidence suggests that much of the problem of the unbanked rests not on their inability to service loans but on financial providers covering the costs of lending.

## I. THE INDONESIA MICROFINANCE ACCESS AND SERVICES SURVEY 2002

The survey was completed in 2002 after the Indonesian economy had stabilized following the financial crisis of 1997–98. The rupiah–US dollar exchange rate rose from 2,383 rupiah (Rp) at the end of 1996 to more than 10,000 Rp in 1998. Inflation also jumped: the consumer price index rose from 115 in 1997 to 182 in 1998. Between 1999 and 2000, however, inflation was about 10 percent, and the rupiah has further depreciated since then, but not precipitously.

While the fall of President Suharto in May 1998 created uncertainties, the transitions to Presidents Habibie and Wahid were mainly peaceful (except in the several regions with secessionist movements). So, the end of 2000 had seen a year of relative calm for most citizens, and the survey respondents were again focusing on longer term plans and investments. By 2002 the financial crisis was safely over, though the political scene remained charged (Patten, Rosengard, and Johnston 2001; Robinson 2002).

4. This finding is echoed in a recent World Bank (2006) study. In a sample of five *kabupaten*, the report finds that 10–20 percent of households may have collateral problems but that lack of collateral does not stand out among the many reasons entrepreneurs cite for not borrowing.

The survey and sample frame map the financial landscape and gauge potential markets for microfinance in Indonesia. Collected in the second half of July and the first half of August 2002, the survey covers 1,438 respondents in six provinces: West Java, East Java, West Kalimantan, East Kalimantan, North Sulawesi, and Papua—provinces with 20.6 million households and 85 million people. The exchange rate was roughly 9,000 rupiah to the dollar on August 1, 2002.<sup>5</sup>

Two *kabupatens* (rural agencies), or *kotamadyas* (urban municipalities), were selected in each province, and from each *kabupaten/kotamadya*, three *kecamatan* (subdistricts) were selected at random.<sup>6</sup> From each *kecamatan*, two *kelurahan/desa* (villages or urban neighborhoods) were selected at random. And respondents were chosen at random from local censuses. There was no attempt to oversample bank customers, and the survey includes both customers and noncustomers. The final survey covers roughly 20 households in each of 72 villages or urban neighborhoods. The results here are weighted (and standard errors are corrected) to reflect the stratification by province and district.

The main enumerators were BRI loan officers, with quality checks and supervision by Jakarta-based BRI staff, with the authors' input. Loan officers were not permitted to collect data in the regions in which they worked, to rule out biases due to collecting information on their own customers or potential customers. The survey gives direct evidence on the living standards of households—on wages and on enterprise revenues (but only a partial reckoning of the cost of family labor and the imputed cost of flows of services and depreciation of assets). The data generate a measure of per capita income for each household, for comparison with regional poverty lines.

The poverty rate for survey households is slightly higher than the official statistics for the country. For rural areas the sample poverty rate is 26.3 percent compared with 21.1 percent in the official statistics. In urban areas the rates are 18.3 percent and 14.5 percent. There is considerable debate about setting poverty lines in Indonesia and the official measures used as a benchmark. Assuming a 30-day month and converting at official exchange rates, the national poverty lines are 36 cents a person a day in rural areas and 48 cents a person a day in urban areas (purchasing power corrected lines are higher).<sup>7</sup> In

5. The exchange rate is from Bank Indonesia. On August 1, 2002, the official sell rate was 9,564; the buy rate was 8,564. Historical exchange rates are available at [www.bi.go.id/bank\\_indonesia\\_english/monetary/exchange/](http://www.bi.go.id/bank_indonesia_english/monetary/exchange/).

6. The *kabupaten/kotamadya* selected for this survey were: West Java—Kabupaten Purwakarta and Kabupaten Bandung; East Java—Kotamadya Madiun and Kabupaten Malang; West Kalimantan—Kotamadya Pontianak and Kabupaten Sanggau; East Kalimantan—Kabupaten Kutai and Kotamadya Samarinda; North Sulawesi—Kotamadya Manado and Kabupaten Minahasa; and Papua (Irian Jaya)—Kotamadya Jayapura and Kabupaten Manokwari.

7. Province data are calculated by Statistics Indonesia (Budan Pusat Statistik), drawing on the 2002 National Socioeconomic Survey (Susenas). There was no price survey for 2002 in Papua, so the poverty line there is the 2001 line increased by the average urban (30 percent) and rural (20 percent) increases between 2001 and 2002 for all Indonesia.

TABLE 1. Summary Statistics for the Sample

Variable	Number of Observations	Mean	Linearized Standard Error
Active borrower anytime between 1999 and 2002 (percent)	1,411	26.5	3.9
Formal or micro bank borrower 1999–2002 (percent)	1,411	23.3	3.3
If per capita income < poverty line	327	7.5	1.8
If per capita income is 1–3 times the poverty line	604	22.1	3.2
If per capita income is more than 3 times the poverty line	474	45.2	5.3
Log(loan amounts in the last two years)	1,396	7.0	0.4
Creditworthy (percent)	1,410	60.5	3.3
If has a household enterprise	1,014	70.5	3.8
Log(feasible maximum amount <sup>a</sup> )	1,380	10.8	0.4
If is creditworthy	899	15.0	0.1
If has a household enterprise	994	11.8	0.4
Log(desired loan amount)	1,003	14.5	0.1
Return on assets <sup>b</sup> (5 percent highest trimmed)	930	0.2	0.0
Has a household enterprise (percent)	1,438	70.3	3.5
Has savings in a savings institution (percent)	1,438	41.5	5.1
Saves but does not borrow (percent)	1,438	16.2	2.2
If has savings in a savings institution	719	39.0	4.1
Percentage of amounts of all loans used for household purposes, if reported loans	544	39.7	4.6

*Note:* The sum of subsample observations can differ from the full sample when the subsample variable includes missing values. All means were obtained with Stata's survey command. For log variables, zero values were replaced with  $\log(100)$ .

<sup>a</sup>The maximum amount that loan officers would lend to the respondent if creditworthy ("feasible"). Values for noncreditworthy respondents were set to  $\log(100)$  in the full sample.

<sup>b</sup>Calculated only for households that have a household enterprise, as net revenue/total household and business assets.

*Source:* Authors' analysis based on data from Indonesia Mass 2002 survey.

the descriptive statistics incomes are normalized as multiples of regional poverty lines, with most income data falling between half the local poverty line and five times that line.

## II. POVERTY AND CREDITWORTHINESS

About a quarter of the sample had borrowed in the three years prior to the survey, and the probability of borrowing specifically from a formal bank or microfinance bank rises steadily with household income from 7.5 percent for poor households to 22 percent for nonpoor households with per capita income up to three times the poverty line (table 1). About 45 percent of better-off

households borrowed from formal or micro banks.<sup>8</sup> The greater probability of borrowing from formalized sources as income rises is consistent with greater access to finance (a greater chance of being judged creditworthy coupled with greater proximity to banks) and stronger demand for loans among higher income groups. The result holds in regressions with a range of control variables.

Of households in the sample, 70 percent have a household enterprise. Of those households, 70.5 percent are deemed creditworthy by the bank staff collecting the survey. In the full sample, 60.5 percent are deemed creditworthy, a fraction that also increases with income. One interest here is in better understanding who is creditworthy.

### *Creditworthiness*

An important motivation for the survey was to identify untapped markets. To that end, the survey took advantage of the fact that most enumerators were credit officers (*mantri*) participating in a region different from their usual place of employment. At the end of the survey, the enumerators were asked to use their professional judgment to evaluate individual households. The evaluation was not shared with the household. The specific question focused on the household's potential creditworthiness for borrowing from BRI—with BRI's existing line of loan products and processes. The enumerators were also asked about the amount of credit, the term of credit worth giving, and for households assessed as not creditworthy, the reason for that decision. The question was: does this household have the capacity to reliably borrow and repay a loan? Separate analysis investigated creditworthiness in a different sense, asking whether making loans to the household would lead to profits or losses for the bank.

The hypothetical loans (characterized explicitly as part of the bank's Kupedes microloan product) are typically for working capital or fixed capital investments in small business, but loan officers also use the product to lend against salaries for customers with steady paychecks. Kupedes loans can be as small as \$3 and as large as about \$5,000, with loan terms ranging between one month and three years.<sup>9</sup> At the time of the survey, the annual effective interest rate on BRI loans was about 40 percent (2.5 percent per month). In practice, though, roughly 90 percent of borrowers get part of their interest costs back in the form of a rebate. If borrowers make all of their payments within a six-month period in a timely manner, they get back 0.5 percent per month,

8. "Micro" banks include credit unions and cooperatives and other banking institutions that are neither fully commercial nor "informal." Some call them "semi-formal" since they are not commercial but maintain professional practices and depend on rules that apply to all customers, rather than rules that vary with customers. Informal providers include moneylenders, local credit and savings clubs, neighbors, and relatives.

9. Details are from the BRI website, accessed April 12, 2008; see [www.bri.co.id/english/produk/produk.aspx?id=2](http://www.bri.co.id/english/produk/produk.aspx?id=2).

making the net annual effective interest rate about 32 percent. Otherwise, the 0.5 percent is kept by the bank as a penalty.

While BRI requires collateral, it seldom takes legal action to take possession of the assets (except in cases of suspected fraud). Loan officers are fairly flexible in what they will accept as collateral, but they typically choose property or vehicles. They are also flexible about required ownership documents: a tax receipt can substitute for formal title. Previous BRI surveys show that about 90 percent of Indonesian households have assets that would qualify as collateral, and the requirement is not viewed by the bank as a major block to the depth of outreach (BRI 1997, p. 7).

Many more households were deemed creditworthy than are actually borrowing from formal lenders: enumerators deemed that 38 percent of households below the poverty line were potentially feasible borrowers from BRI, 64 percent in the middle group, and 82 percent at the top (table 2).

The enumerators identified creditworthy households far down the income ladder, and the results suggest the difficulty in making blanket statements about the poor and their opportunities. Yunus (2008) argues that credit is a “human right” even for the poorest, suggesting an imperative to make lending universal. But others, like Robinson (2001, p. 21), argue that the very poor are likely to be ill-suited for commercial borrowing, a result echoed in the determination by enumerators here that 62 percent of the poor households in the sample would not be good prospects for borrowing (see table 2). But the enumerators identified 38 percent of poor households that would be viable borrowers—given BRI’s existing loan products and processes. Even at per capita income under half the official poverty line, enumerators identified 36 percent of households as creditworthy. At every level of income, many more households were deemed eligible to borrow than were actually doing so (figure 1). The question is, why do the gaps persist?

### *Collateral*

One often-cited reason for gaps in credit markets is the lack of collateral (Stiglitz and Weiss 1981). Hernando de Soto (2000) argues strongly that the lack of legal title to assets holds back the poor. His argument hinges on the ability of title to transform assets into collateral and thus to secure capital, ultimately generating income for the poor. Without title, he argues, the capital is “dead,” unhelpful in generating the leverage needed to climb from poverty.<sup>10</sup>

The average asset holdings (and possession of title or other ownership documents) is not dramatically different for households below the poverty line and those one rung up the income distribution (row 2 of table 2). While households on the rung just above the poverty line have more assets, they are not much more likely to have better documentation.

10. See Woodruff (2001) for a critical review of de Soto’s (2000) *The Mystery of Capital*.

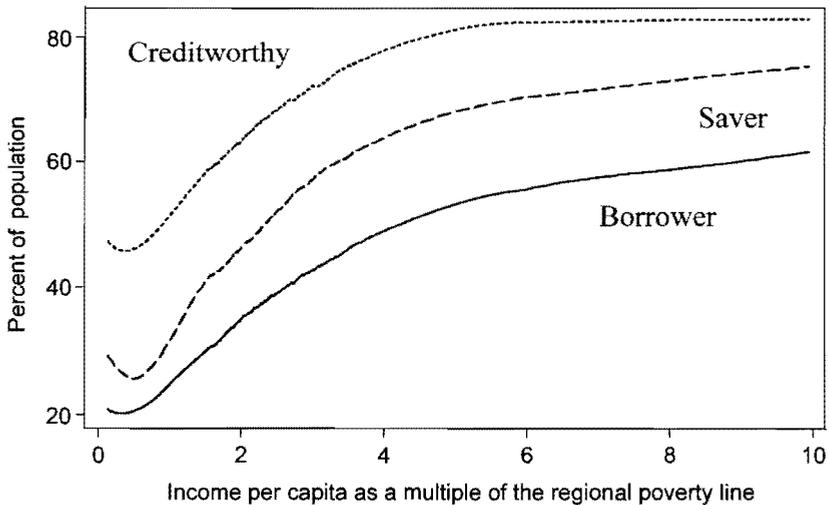
TABLE 2: Creditworthiness and Assets

Creditworthiness Indicator	Per Capita Income is below the Poverty Line	Per Capita Income is One to Three Times the Poverty Line	Per Capita Income is more than Three Times the Poverty Line
Creditworthy?	38 (5)	64 (4)	82 (5)
<b>Assets</b>			
Fixed assets (million rupiah)	25.5 (3)	37.7 (4)	99.9 (22)
Assets with legal title (percent)	24 (9)	27 (5)	44 (6)
Assets with other documents (percent)	68 (8)	69 (6)	54 (6)
Number of observations	330	617	485
<b>Reasons for lack of creditworthiness (percent)</b>			
Security deficient	1.9 (1.2)	3.6 (2.6)	3.8 (3.8)
Income deficient	81.3 (5.0)	78.1 (5.0)	68.4 (13.2)
Poor character/history	1.7 (1.7)	0.3 (0.2)	0.04 (0.04)
Administrative problems/other	15.1 (3.8)	17.9 (5.5)	27.7 (11.6)
Number of observations	168	215	81

Note: Reasons for lack of creditworthiness are as described by enumerators' professional and confidential assessment of creditworthiness. Numbers in parentheses are adjusted standard errors.

Source: Authors' analysis based on data from Indonesia Mass 2002 survey.

FIGURE 1. Likelihood of being Judged Creditworthy, being a Borrower, and using a Savings Account or Device



Source: Authors' analysis based on data from Indonesia Mass 2002 survey.

TABLE 3. Creditworthiness

Independent variable	Creditworthy, All		Log(Feasible Max Amount)	Log(Desired Amount)	Creditworthy	Log(Feasible Max Amount)
	(1)	(2)	All (Left-Censored Tobit)	All	Household Enterprise	Household Enterprise (Left-Censored Tobit)
			(3)	(4)	(5)	(6)
Log(desired loan amount in million rupiah)		0.155*** (0.041)				
Desired loan amount < 1.9 million rupiah		-0.198 (0.171)				
Desired loan amount < 1.3 million rupiah		0.035 (0.172)				
Log(per capita income in million rupiah)	0.101** (0.048)	0.072 (0.066)	1.417*** (0.499)	0.227*** (0.071)	0.034 (0.059)	0.277 (0.450)
Log(total fixed assets in billion rupiah)	0.083** (0.039)	0.063* (0.034)	1.059** (0.502)	0.216*** (0.054)	0.152** (0.066)	1.915*** (0.739)
Share of fixed assets with title	0.025 (0.082)	0.013 (0.137)	-0.152 (1.218)	0.121 (0.292)	0.091 (0.097)	0.562 (1.193)
Share of fixed assets with other document	-0.046 (0.088)	0.044 (0.123)	-0.865 (1.406)	-0.094 (0.243)	0.069 (0.063)	0.484 (1.069)
Log(monthly return to total assets, 5 percent highest trimmed)					0.133*** (0.042)	1.759*** (0.543)
High/Above average business risk					0.158 (0.103)	1.288** (0.644)
Number of quiet months is above median					-0.035 (0.089)	-0.573 (0.858)
Rural	-0.128 (0.174)	0.093 (0.105)	-3.487 (2.649)	-0.452 (0.327)	0.083 (0.168)	-0.209 (1.819)
Poor × Rural	-0.139*** (0.049)	-0.081 (0.071)	-2.273*** (0.634)	-0.325** (0.137)	-0.147 (0.100)	-1.942** (0.786)

Log(household age)	-0.083 (0.067)	0.042 (0.071)	-1.027 (0.927)	-0.504*** (0.148)	-0.145 (0.118)	-1.608 (1.111)
Log(household education)	-0.047 (0.052)	-0.099 (0.077)	-0.321 (0.581)	0.329*** (0.079)	-0.114* (0.058)	-0.797* (0.442)
Log(household size)	0.092 (0.080)	0.037 (0.088)	1.516 (0.965)	0.495*** (0.187)	0.113 (0.086)	1.161 (0.755)
Female head of household	0.027 (0.104)	0.037 (0.144)	0.190 (1.228)	0.026 (0.234)	0.037 (0.120)	0.036 (1.101)
Constant			-21.956** (9.484)	10.460*** (1.108)		-19.090 (16.389)
Log( $\sigma$ )			1.824*** (0.055)			1.615*** (0.069)
Number of observations	1,366	957	1,338	969	919	903
R <sup>2</sup>				0.486		

\*Significant at the 10 percent level; \*\*significant at the 5 percent level; \*\*\*significant at the 1 percent level.

*Note:* Numbers in parentheses are standard errors. Dummy variables for *kecamatan*s (geographic area) were included in all models but are not displayed. The feasible dummy variable has 1,410 observations. The log(feasible max amount) has 1,380 observations, after replacing by log(100) if not feasible. Desired loan amount has 1,003 observations. It was supposed to be asked only of respondents who never borrowed, but data cross-tabulations do not indicate this. The numbers of observations vary because of dropping *kecamatan*s and missing values in other variables. In columns 5 and 6 the sample is limited to 1,027 households with an enterprise; the variable return on assets was trimmed so the usable number of observations is 930. Dependent variables are columns 1, 2, and 5, a dummy variable equal to one if the enumerator judged the respondent creditworthy; 3 and 6, the log of the maximum loan amount (in million rupiah) that enumerators would lend to creditworthy respondents; and 4, the loan amount that nonborrowers would like to borrow from a formal financial institution if they had the opportunity. Binary dependent variables were estimated with probits, and coefficients indicate the marginal effect from the mean; logs were estimated with ordinary least squares; all regressions were estimated using survey commands. For the log of income and assets, zero values were replaced with log(100). For the log of household education, zero values were replaced with log(1.1).

*Source:* Authors' analysis based on data from Indonesia Mass 2002 survey.

The enumerators were asked why they rejected the given households. For poor households, 81 percent of the time the reason centered on deficiencies in the household's income or business rather than on the ability to pledge assets as security (bottom panel of table 2). A lack of collateral was highlighted less than 2 percent of the time. The result is consistent with BRI's lending method, based in large part on lending against expected household income flows (and the bank's confidence in timing loan repayment installments to capture cash flows before they are diverted). The approach departs from the traditional banking method of lending primarily against assets.

Table 3 presents regression analyses of the correlates of creditworthiness. Columns 1, 2, and 5 focus on the enumerator's yes–no decision using probit estimation, where a binary indicator of the staff member's judgment of creditworthiness is the dependent variable. The coefficients have been transformed to give marginal effects relative to the mean. Creditworthiness is, of course, seldom a black or white idea, and columns 3 and 6 focus on the enumerator's estimation of how much money BRI would lend, modeled as a Tobit. Column 4 investigates how much individuals would like to borrow from a formal source if given the chance. Specifications include fixed effects for district to control for regional differences, and robustness checks with fixed effects for enumerator did not yield important changes in the results.

Column 1 shows that creditworthiness rises with income and asset-holding, even after controlling for location, household average age, education, size, and whether the household is headed by a woman. Neither question on assets with a title (a formal title or another formal document, like a tax receipt) enters significantly, and the coefficients are relatively small. The finding, in keeping with the summary statistics, plays out in all six columns. (As a robustness check, the regressions were disaggregated by income group, with similar results, which are not reported here.)

The coefficients give associations not causal relationships. The positive association of creditworthiness with income and assets may be due in part to reverse causation (people who are more creditworthy gain access to finance, which then yields income and provides resources to secure title). To the extent that endogeneity affects the coefficients on the two titling variables, the bias ought to be positive. Thus the “nonresults” here on titling are all the more striking, since endogeneity bias would push the coefficients upward.

The remaining columns in table 3 yield results similar to those in the first column: having more assets is always positively associated with creditworthiness. Column 5 shows that for households with businesses, greater profitability (as measured by returns to assets) increases creditworthiness, an unsurprising finding. Neither risk nor seasonality is a critical correlate of creditworthiness. The results in most columns indicate that being poor and living in a rural district strongly diminish the association with creditworthiness. For example, in column 1, the coefficient on the indicator for being poor and rural in the regression on being judged creditworthy is  $-0.139$ , even after controlling for

income and rural status. The rural poor appear to face particularly large gaps: they are both less likely to be deemed creditworthy and less likely to be deemed worthy of a relatively large loan conditional on creditworthiness.

### *Small Desired Loan Sizes*

The survey asked: "If this household can borrow the desired amount of money from a formal financial institution, what would be deemed the most appropriate use for said loan? What is the desired loan amount?" The questions are asked only of households that have not recently borrowed and provide the opportunity to gauge whether loan officers take loan size into account here.

Column 2 of table 3 shows that households seeking larger loans are more likely to be deemed creditworthy, a bias that pushes banks toward better-off customers. The result emerges even after controlling for income, location, education, and asset-holding. The second and third rows focus on the correlation with knowing that customers seek loans that are particularly small, while the first row picks up the overall association with desired loan size.

"Particularly small" is used here in a precise sense. BRI estimated the minimal loan size that allows it to break even on a loan transaction (Bank Rakyat Indonesia and Harvard Center for Business and Government 2003). The calculation takes into account expected interest payments adjusted for nonpayment and the costs of lending (including staff salaries, training, and supervision). In December 2002 the breakeven loan size was Rp 1.9 million (about \$210), the amount needed to cover total costs. If the bank aims only to cover the marginal cost of additional lending, the December 2002 figure is Rp 1.3 million (about \$145). In column 2, the indicator of seeking a loan under the Rp 1.9 million threshold takes a sizable negative coefficient, though it is not significant. The indicator for seeking a loan under Rp 1.3 million is only 0.035, with a standard error of 0.17. The results are consistent with loan officers judging creditworthiness as the ability of households to repay loans but not—as a bank manager might—judging whether the loans make good business sense for the bank.

Introducing these variables also sharply reduces the size of the coefficient on the indicator from being rural and poor—from  $-0.139$  in column 1 to  $-0.81$  in column 2. The link is seen as well in column 4, which shows the strong association of desiring relatively small loans and being poor and rural. Serving poor and rural populations thus appears bound up with making small loans.

Table 4 probes further, giving descriptive data on the desire for small loans, disaggregated by income groups. For households under the poverty line, two-thirds of respondents desired a loan under the BRI Rp 1.9 million breakeven size (compared with 38 percent in the middle group and 25 percent among the better-off). A clear distinction can be seen among households judged creditworthy and those not. Here, 48 percent of creditworthy poor households seek loans under the breakeven line, while 79 percent of the noncreditworthy poor households do. The pattern is even sharper for the higher income groups. The bottom panel gives

TABLE 4. Percentage of Respondents Who Desire a Small Loan

Type of Respondent	Per Capita Income is below the Poverty Line	Per Capita Income is One to Three Times the Poverty Line	Per Capita Income is more than Three Times the Poverty Line
Desired loan amount < 1.9 million rupiah			
Full sample	67 (6)	38 (3)	25 (5)
If has an enterprise	60 (8)	30 (4)	30 (6)
If creditworthy	48 (10)	24 (3)	15 (5)
If not creditworthy	79 (7)	63 (6)	60 (13)
Number of observations in full sample	268	451	281
Desired loan amount < 1.3 million rupiah			
Full sample	62 (8)	35 (3)	21 (5)
If has an enterprise	54 (9)	27 (4)	26 (6)
If creditworthy	42 (8)	21 (3)	13 (5)
If not creditworthy	74 (9)	60 (6)	51 (14)
Number of observations in full sample	268	451	281

*Note:* Numbers in parentheses are linearized standard errors. Desired loan size was asked of 1,003 respondents, but the income variable is missing three observations among these. Percentages are of respondents who reported wanting to borrow less than 1.9 million rupiah (BRI's marginal cost of a loan) or 1.3 million rupiah (average cost to BRI in 2002 to transact a loan) if they could borrow from a formal financial institution.

*Source:* Authors' analysis based on data from Indonesia Mass 2002 survey.

similar numbers for desired loans under Rp 1.3 million, the marginal cost of lending. Sixty-two percent of poor households desire loans smaller than the threshold, and 42 percent of households deemed creditworthy do.

Table 2 showed that 38 percent of poor households in the sample were deemed creditworthy. Table 4 shows that 42 percent of those households seek loans too small to be profitable even for a microlender like BRI. Putting the pieces together suggests a gap in access to credit. Just 22 percent of the poor households in the sample are both judged able to repay loans and seek loans large enough to be profitable. Given that 7.5 percent of the poor households in the sample are already borrowing from a formal bank or microlender, the gap in access shrinks further. So, banks like BRI can go further in penetrating this population, but larger impacts will require innovations to reduce the costs of making small loans—or will require adjusting fees further upward.

### Summary

Table 5 turns to the borrowing experiences of the households, echoing the results in table 3. There is a strong positive association of income and assets with financial use, even after controlling for a broad range of nonfinancial

TABLE 5. Borrowing

Independent variable	Active Borrower (1999–2002) (1)	Active Borrower from Formal or Micro Source (2)	Log(Amount of all Loans in Last Two Years) (3)
Log(per capita income in million rupiah)	0.032 (0.027)	0.043** (0.020)	1.462** (0.668)
Log(total fixed assets in billion rupiah)	0.063*** (0.017)	0.065*** (0.016)	2.119*** (0.672)
Share of fixed assets with title	-0.107 (0.139)	-0.033 (0.117)	-4.577 (4.805)
Share of fixed assets with other document	-0.137 (0.129)	-0.134 (0.103)	-7.316* (4.218)
Household enterprise? (yes = 1)	0.015 (0.048)	0.011 (0.046)	2.245 (1.573)
Rural	-0.458 (0.291)	0.103 (0.079)	7.470 (4.731)
Poor × Rural	-0.190*** (0.056)	-0.151*** (0.033)	-6.555*** (2.228)
Log(household age)	0.055 (0.074)	0.038 (0.078)	0.417 (2.526)
Log(household education)	0.068 (0.048)	0.058 (0.039)	2.214 (1.738)
Log(household size)	0.110* (0.060)	0.073 (0.057)	4.334** (1.896)
Female head of household	-0.003 (0.051)	-0.036 (0.054)	-0.534 (1.973)
Constant			-73.964*** (12.876)
Log( $\sigma$ )			2.387*** (0.070)
Number of observations	1,362	1,362	1,347

\*Significant at the 10 percent level; \*\*significant at the 5 percent level; \*\*\*significant at the 1 percent level.

*Note:* Numbers in parentheses are standard errors. Dummy variables for *kecamatan*s (geographic area) were included in all models and are not displayed. Numbers of observations vary from the total in the sample (1,438 observations) due to dropping *kecamatan*s and missing loan amounts. Dependent variables are column 1, a dummy variable equal to one if the respondent borrowed between 1999 and 2002; column 2, a dummy variable equal to one if the respondent borrowed from a formal source or microlender between 1999 and 2002; and column 3, the log of all loan amounts taken in the two years before the survey; zero values were replaced with log(100). Columns 1 and 2 were estimated with probits and coefficients indicating the marginal effect from the mean; column 3 was estimated with a Tobit. Errors in binary regressions were corrected for the stratified survey structure.

*Source:* Authors' analysis based on data from Indonesia Mass 2002 survey.

variables. Being poor and rural is strongly associated with lower financial use, and there is very little role for having formal title or another document. In column 3, which considers the cumulative sum of borrowing rather than borrowing status, the titling variables are negative, in one case significantly so at the 10 percent level. The negative coefficients go against expectations. The

broad point is that once again the coefficients on the titling variables are neither positive nor large and statistically significant—and here they are surprisingly negative and remain a puzzle.

Taken as a whole, the evidence in tables 2, 3, and 5 yields a tempered view of de Soto's case. He appears to be too pessimistic about prospects for spreading banking to a large share of the poor without major titling campaigns. He is right that having more assets is closely associated with access to capital, but in this sample having formal title to those assets is not associated closely with professional assessments of creditworthiness for microfinance borrowing, nor do formal titles go far in explaining existing borrowing activity. This is good news for those who wish to expand financial access through innovative practices such as those followed by Grameen Bank and BRI. De Soto's case likely has more bite for lending at the small and medium-size enterprise level, but we the sample size is too small to draw any firm conclusions.

In a different way, though, de Soto is also too optimistic about the prospects for microlending, at least through a large lender like BRI. If lack of creditworthiness for the 62 percent of "rejected" poor households is a deficiency in income or business performance (as seen in table 2), low incomes will be far harder to overcome than simply by implementing a titling program. Moreover, table 4 shows that most individuals under the poverty line seek loans too small to interest a commercially minded microfinance bank like BRI.

### III. USES OF LOANS BEYOND MICROCREDIT FOR MICROENTERPRISE

Microcredit has been closely bound up with the desire to promote microenterprises, the small businesses of low-income households. Many of the businesses are so small that they employ no one but the proprietor. Yunus's vision in building Grameen Bank was to reduce poverty by helping borrowers expand their small enterprises. Robinson (2001, Ch. 3), while disagreeing with Yunus at key points, also maintains the sharp focus on lending for microenterprise. She offers a stream of anecdotes that stress the way credit helps small businesses grow, taking examples from Argentina, Kenya, the Kyrgyz Republic, Indonesia, Nicaragua, Philippines, and Senegal (pp. 107–20). By helping to build microenterprise, it is hoped, microcredit can expand production and generate income for borrowers.

Table 6 affirms the importance of small business loans, but it also shows that half of the volume of loans of poor borrowers in the survey are for purposes unrelated to business.<sup>11</sup> The data give the stated use of the last loan taken from each source. Since less than a third of the sample borrows (and only a seventh of poor households), cell sizes are small; the total sample of

11. The findings complement small-scale surveys of 53 households in three sample branches of Grameen Bank that show that Grameen Bank loans, nominally made for business purposes, are often redirected toward nonbusiness ends (Rutherford 2006). Collins and others (forthcoming) present similar evidence from Bangladesh, India, and South Africa.

TABLE 6. Loan Uses (Percent of Loan Amount)

Loan use	Per Capita Income is below the Poverty Line	Per Capita Income is One to Three Times the Poverty Line	Per Capita Income is More than Three Times the Poverty Line
Loan use			
Business	48 (6)	54 (6)	50 (7)
Household	35 (8)	40 (7)	41 (7)
Other	15 (7)	5 (3)	7 (5)
Number of observations	68	201	269
Household enterprise?	85 (7)	78 (4)	67 (8)
Loan use if household has enterprise			
Business	54 (8)	68 (5)	62 (7)
Household	27 (8)	24 (6)	29 (6)
Other	15 (7)	5 (3)	7 (6)
Number of observations	55	145	168

*Note:* Numbers in parentheses are standard errors. Loan amounts are total amount of all loans recorded during the interview.

*Source:* Authors' analysis based on data from Indonesia Mass 2002 survey.

borrowers is just 538. Despite the small sample, the patterns are consistent—and similar for poor households and for borrowers above the poverty line. Stated uses of loans include home improvement, nonbusiness land or building purchase, school tuition, medical treatment, loan repayment, daily needs or retirement needs, vehicle purchase, household goods, ceremony or social expenditure, holiday needs, or jewelry purchase.<sup>12</sup>

Part of the explanation of the results rests with the fact that only 70 percent of households in the sample operate a family enterprise (though 85 percent of poor households do so). Not surprisingly, borrowing for business is somewhat more likely if a household has a business (see table 6, bottom panel). But even then, the share of borrowing for business purposes by poor households rises from 48 percent to only 54 percent.

Table 7 provides regression results restricted to the sample of borrowers, with the same type of specification used in table 5. The dependent variable is the percentage of a household's loans (by value) used for household purposes. In column 1 the share is not affected strongly by a household's wealth or income. Being more educated increases the prevalence of borrowing for

12. A related piece of evidence comes from households not currently borrowing from formal banks. These households were asked their favored uses for loans, if they were to borrow from a formal bank. With a sample size of 1,028, business uses were again important, but 31–44 percent of loans were marked for nonbusiness purposes.

TABLE 7. Loan Uses

Independent Variable	Loan Amounts used for Household Purposes (Percent)	
	1	2
Log(per capita income in million rupiah)	0.014 (0.047)	0.011 (0.045)
Log(total fixed assets in billion rupiah)	0.002 (0.031)	0.003 (0.029)
Share of fixed assets with title	-0.362* (0.204)	-0.322 (0.207)
Share of fixed assets with other document	-0.122 (0.166)	-0.152 (0.175)
Household enterprise? (yes = 1)		-0.382*** (0.118)
Rural	-0.596*** (0.195)	-0.607*** (0.201)
Poor * Rural	0.173 (0.166)	0.138 (0.135)
Log(household age)	0.099 (0.113)	0.072 (0.103)
Log(household education)	0.271*** (0.054)	0.193*** (0.053)
Log(household size)	0.008 (0.075)	0.070 (0.073)
Female head of household	0.340*** (0.087)	0.241*** (0.080)
Constant	-0.198 (0.735)	0.371 (0.684)
Number of observations	533	533
R <sup>2</sup>	0.252	0.320

\*Significant at the 10 percent level; \*\*\*significant at the 1 percent level.

Note: Numbers in parentheses are standard errors. Dummy variables for *kecamatan*s (geographic area) were included in all models and are not displayed. The full sample includes 544 respondents who reported loan amounts. The dependent variable is the percentage of all loan amounts used for household purposes. The model was estimated by ordinary least squares using survey commands.

Source: Authors' analysis based on data from Indonesia Mass 2002 survey.

consumption, largely because more educated households do not run micro-enterprises. Female-headed households are also much more likely to borrow for consumption, perhaps because income flows are less stable and diversified, requiring borrowing for consumption smoothing.

Column 2 controls for whether the household owns a business. The coefficient, -0.38, is strongly negative and statistically significant, as expected. Entering the variable does little to change the picture given by the other coefficients, however, which is a result that makes sense in light of the descriptive statistics in table 6: even households with household enterprises seek loans for nonbusiness purposes. In column 2, the share of assets with title is smaller and

no longer statistically significant, consistent with the variable serving as a proxy for having a business.

Preliminary analyses (not shown here) suggest that loans from the informal sector are tilted even more toward household purposes than loans on average. That piece of evidence, to the extent that it holds up in larger and different samples, complicates the ability to make the empirical leap embodied in an argument commonly heard in defense of the relatively high rates of interest charged by commercially driven microfinance institutions. Helms and Reille (2004, p. 1) compare interest rates charged by microlenders to rates charged in “informal credit markets (such as local moneylenders), which are even more expensive.” To the extent that loans from informal credit markets are used for broadly different purposes than loans from formal sector and microfinance banks, microfinancial loans and moneylender loans are not obvious substitutes.<sup>13</sup>

#### IV. CONCLUSION

The “unbanked” are a broad and differentiated population, though often lumped together in policy analyses. Differentiating between households facing credit rationing and households not creditworthy or averse to debt is a critical first step in locating the frontiers of financial access. One of the most important findings here is that a substantial group of the poor households in the sample—roughly 40 percent—is creditworthy using the lending criteria of BRI’s microfinance unit, the country’s leading “commercial” microfinance provider. Fewer than 10 percent of poor households had recently borrowed from a formal bank or a registered microfinance bank, suggesting that the banking sector is far from exhausting the present market.

Part of the gap between financial use and creditworthiness may be narrowed through information and marketing drives, given that households may not know that they qualify for credit. But the evidence here does not provide optimism that banks will, on their own, make much effort to tell them: poor customers, especially those who seek small loans with limited profit potential for banks, are lower priorities for commercial microfinance banks in Indonesia. Two-thirds of poor households, when asked, desire loans too small to be profitable for microlenders like BRI (based on calculations from BRI’s internal accounts).

The larger question is not whether a substantial number of borrowers below poverty lines are potentially creditworthy—the evidence suggests that they are. Rather, the question is a supply-side one: can potential borrowers be served within the constraints of an institution’s business and social model? The

13. Another way to interpret the finding is that Kupedes loans are cheap enough (and for long enough terms) to use for business purposes, while the more expensive credit has to be reserved for more urgent, “distress” situations.

enumerators spent roughly an hour and a half with customers in their homes before making their judgments—time that would not normally be available to credit managers.

Policymakers can promote the expansion of financial access for the poor by supporting technological innovations (and their application) that lower the costs of screening potential customers (credit scoring) and that reduce transaction costs (hand-held computers in the field and automatic teller machines). In some areas, group-lending methods in the spirit of those pioneered by Grameen Bank can also cut transactions costs for institutions serving particularly poor customers.

The evidence also suggests a potential mismatch of products and customer demand. One consistent finding is the priority that households place on loans for consumption purposes, although many loan products are designed for supporting small-scale businesses. While microcredit advocates focus sharply on loans for business in promoting microcredit, microcredit customers in this sample look to the financial system to meet a much broader range of needs. The finding suggests the need to move from thinking exclusively of “microcredit for microenterprise” toward credit for general purposes.

The broadest implication, and perhaps the most important, is that reality aligns neither with Yunus’s optimistic view that all (or nearly all) the poor can reliably service loans, nor with the pessimistic view that today’s unbanked households are fundamentally noncreditworthy. A large minority of unbanked poor households have the demand and capacity to be reliable bank customers—as judged by bank staff themselves. The challenge remains to further develop business models that support lending at small scales.

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# Patterns of Rainfall Insurance Participation in Rural India

*Xavier Giné, Robert Townsend, and James Vickery*

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Take-up of an innovative rainfall insurance policy offered to smallholder farmers in rural India decreases with basis risk between insurance payouts and income fluctuations, increases with household wealth, and decreases with binding credit constraints. These results are consistent with the predictions of a simple neoclassical model with borrowing constraints. Other patterns are less consistent with the benchmark model. For example, participation in village networks and measures of familiarity with the insurance vendor are strongly correlated with insurance take-up decisions, and risk-averse households are less, not more, likely to purchase insurance. These results may reflect household uncertainty about the product, given their limited experience with it. JEL Codes: O10, O16, G2, G22

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Insurance markets are growing rapidly in the developing world. As part of this growth, innovative products allow individual smallholder farmers to hedge against agricultural risks, such as drought, disease, and commodity price fluctuations. A World Bank (2005b) volume examines 10 case studies in countries as diverse as India, Malawi, Nicaragua, and Ukraine. Each case study describes

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index insurance, a product whose payouts are linked to a publicly observable index, such as rainfall recorded on a local rain gauge. Advocates argue that index insurance is transparent and inexpensive to administer, enables quick payouts, and minimizes moral hazard and adverse selection problems associated with other risk-coping mechanisms and insurance programs.

These financial innovations hold significant promise for rural households. Shocks to agricultural income, such as a drought-induced harvest failure, generate movements in consumption for households that are not perfectly insured; at the extreme they may lead to famine or death. The evidence suggests that households in developing countries are only partially insured against income shocks (see, for example Townsend 1994; Morduch 1995; and Lim and Townsend 1998). Moreover, weather events tend to affect all households in a local geographic area, making other risk-sharing mechanisms, such as interhousehold transfers and local credit and asset markets, less effective at mitigating the impact of the shock.

Households engage in costly *ex ante* risk-mitigation strategies to reduce fluctuations in agricultural income. Morduch (1995) summarizes a range of evidence of this kind of household income smoothing. Indian farmers near subsistence level spatially diversify their plots, for example, and devote a larger share of land to lower yielding, traditional varieties of rice and castor. These activities reduce the variability of agricultural revenues, but they do so at the cost of lower average income.

This article studies a particular rainfall insurance product offered in recent years to smallholder farmers in the Andhra Pradesh region of southern India. The product provides a payout based on rainfall during the three phases of the monsoon season. It is inexpensive enough to be accessible to farmers of modest income. A policy covering all three phases of the monsoon costs about 150–250 rupees (Rs) (equivalent to \$4–\$6). The product is sold to farmers by BASIX, a microfinance institution; rainfall risk is underwritten by the insurance firm ICICI Lombard and its reinsurers.

A basic research question for the study of microinsurance markets is estimating the cross-sectional determinants of household insurance take-up and identifying the impediments to trade that prevent remaining households from participating. After describing the insurance product, this article presents empirical evidence on the determinants of insurance participation based on a household survey implemented by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and the World Bank in late 2004. The article first evaluates take-up patterns against a simple neoclassical benchmark, which predicts that insurance participation is increasing in risk aversion and the variance of risk and decreasing in basis risk between insurance payouts and the risk to be insured. Some evidence consistent with the basis risk prediction is found: households that historically plant a high share of castor and groundnut, the two crops for which contracts are designed, are more likely to purchase insurance. Take-up rates are also higher among wealthy households and lower

among households identified as credit constrained. These findings are consistent with an extension of the benchmark model to include borrowing constraints.

Other evidence is more difficult to reconcile with the benchmark model. Among the most significant determinants of insurance take-up are variables measuring the household's degree of familiarity with the insurance vendor, such as whether the household is already a BASIX customer. Participation is also higher among households that are members of the village Gram Panchayat (local council) and those that are connected to other village networks, especially when a larger number of other members or the household's primary network also buy insurance. Risk-averse households are somewhat less likely to purchase rainfall insurance, not more likely, as the neoclassical framework would suggest. This result is concentrated among households that are unfamiliar with BASIX or do not use other types of insurance.

These findings can be interpreted to suggest that many households are uncertain about the insurance product, leading risk-averse households, households with higher costs of evaluating new technologies, and households that are less familiar or place less trust in the insurance provider to eschew purchasing insurance. This interpretation is consistent with qualitative evidence. Lack of understanding about the product was the most common explanation cited by households for not purchasing insurance, and a significant fraction of purchasers cited "advice from others" as a reason for their decision to buy.

These results represent a first step toward understanding the barriers to household participation in microinsurance contracts. Some of the results may reflect the process used to market the product. The results on the role of networks and familiarity with BASIX, for example, may partly reflect the more intensive marketing of the insurance product to village opinion leaders and existing customers. Ongoing research by the authors is examining insurance participation using a randomized field experimental design that explicitly controls for the type of information and marketing received by households. This is also the approach taken by Cole, Tobacman, and Topalova (2008), who study take-up of a rainfall insurance product by households in Gujarat. They find that wealth is positively correlated with insurance take-up. They also find that the framing of the insurance product has a significant impact on the household's decision to purchase insurance.

Section I outlines the concept of index insurance, and section II describes the insurance contract features and related institutional details. Section III discusses theoretical determinants of insurance participation and introduces the hypotheses to be tested. Section IV discusses the survey and presents summary statistics. Section V presents empirical results, and section VI offers concluding remarks.

## I. THE PROMISE OF INDEX INSURANCE

Index insurance provides a payout based on the realization of a publicly verifiable aggregate index, such as rainfall at a local rain gauge or an areawide

measure of crop yields. The goal of such insurance is to insulate income and consumption against aggregate shocks that are plausibly exogenous to the household.

Index insurance minimizes or eliminates moral hazard and adverse selection problems that otherwise distort behavior in insurance markets. It does so because payouts are determined by exogenous information that is unaffected by either unobserved household characteristics (adverse selection) or ex post household decisions (moral hazard). A properly designed index has at least five desirable features: it is transparent and verifiable to policyholders; its calculation is not vulnerable to tampering or manipulation; its probability distribution can be accurately estimated, so that the product can be appropriately priced and the expected return assessed by households; it can be measured inexpensively and in a timely fashion; and the realization of the index, or a transformation of the index, is highly correlated with household income and consumption risk.

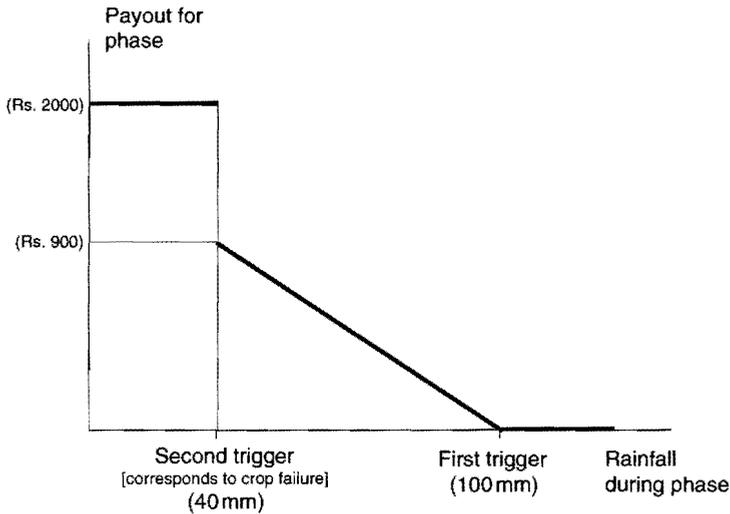
The most widespread index-type insurance available in India is the government-operated National Agriculture Insurance Scheme, which provides a payout based on measured area-level yields on individual crops. In participating states, farmers are required to purchase the insurance if they take a crop loan from a formal financial institution; other farmers can purchase the insurance voluntarily (Kalavakonda and Mahul 2005; Mishra 1996). (For more information, see the supplemental appendix to this article, available online at <http://wber.oxfordjournals.org>, which describes the insurance in more detail and summarizes its costs and benefits relative to rainfall insurance.)

A necessary feature of any insurance contract is that payoffs be correlated with household income and consumption. The evidence suggests that deficient rainfall is a key risk faced by rural Indian households. The supplemental appendix presents self-reported rankings from survey data of the importance of different risks faced by households. An overwhelming proportion of households (88 percent) cite drought as the most important risk they face. Crop failure for reasons other than drought and crop disease are the second and third most frequently cited reasons. Consistent with these self-reports, the World Bank (2005a) estimates that a severe drought would reduce rice yields by 45 percent in Ananthapur and 26 percent in Mahbubnagar, a potentially devastating loss of income for households near subsistence level.

## II. POLICY DESIGN AND MARKETING

The rainfall insurance product studied here is designed to insure farmers in semiarid tropical areas of India against deficient rainfall. It was developed by the general insurer ICICI Lombard, with technical assistance from the World Bank. ICICI Lombard partners with local financial institutions, which market the product to farmers. In the Ananthapur and Mahbubnagar districts of

FIGURE 1. Structure of Insurance Contract



Andhra Pradesh, where the product was piloted in 2003 and 2004, this role is performed by BASIX, a microfinance institution.

#### *2004 Contract Design*

Rainfall insurance policies for 2004 were designed for the two main cash crops in the region: castor and groundnut.<sup>1</sup> These crops are more profitable than food crops, such as pulses, but they are also more sensitive to drought. Because the seeds are relatively expensive, some farmers use crop loans to purchase them; but when the harvest fails these loans are often difficult to repay (Hess 2002).

The coverage for all policies is the monsoon season—the prime cropping season—which runs from June to September. The insurance contract divides the season into three phases, sowing, podding/flowering, and harvest (figure 1). An upper and lower rainfall threshold is specified for each phase. The policy pays zero if accumulated rainfall exceeds the upper threshold; otherwise, the policy pays a fixed amount for each millimeter of shortfall relative to the upper threshold, until the lower threshold is reached. If rainfall falls below the lower threshold, the policy pays a fixed (higher) payout. The total payout is the sum of payouts across the three phases.

The timing of phases, thresholds, and other parameters of the contract were determined using the PNUTGRO crop model (Gadgil, Rao, and Rao 2002) and interactions with farmers. The upper threshold corresponds to the crop's

1. This discussion draws in part on World Bank (2005b) and Giné and others (2005). Cole and Tufano (2007) present additional details about the product background and BASIX's commercial incentives in marketing rainfall insurance policies.

water requirement; the second trigger is intended to equal the water requirement necessary to avoid complete harvest failure.

The policy premium was initially benchmarked on projected payouts using historical rainfall data (at least 25 years of data for each rain gauge were used). The premium was calculated as the sum of the expected payout, 25 percent of its standard deviation, 1 percent of the maximum sum insured in a year, plus a 25 percent administrative charge and 10.2 percent government service tax. In some cases the premium dictated by this formula was then reduced, because it was believed to exceed farmers' willingness to pay. The policy was targeted toward small and medium-size farmers with 2–10 acres of land. Sales were not limited to this group, however; any household in the targeted villages was eligible to purchase the insurance product.

### *Example*

Mahbubnagar district includes three *mandals* (counties) with reference weather stations (Atmakur, Mahbubnagar, and Narayanpet) against which contracts are written. In Narayanpet the premium for a policy covering all three phases of the monsoon was Rs 200 in 2004. One policy is considered equivalent to one acre of coverage. In 2004 the start date for the monsoon was set as June 10, and the first phase was 35 days long. Narayanpet received 12 millimeters of rain in the first phase, 84 millimeters of rain in the second phase, and 177 millimeters of rain in the third phase (table 1). This resulted in a maximum lump sum payout of Rs 1,500 in the first phase, as accumulated rainfall fell below the lower trigger of 60 millimeters. Rainfall during the second phase was also deficient but exceeded the lower trigger level, resulting in a payout of Rs 240 per acre insured [ $240 = (100 \text{ millimeters} - 84 \text{ millimeters}) \times 15$ ]. Rainfall exceeded the upper threshold value in the third phase. Insured households in Narayanpet thus received total payouts of Rs 1,740 per policy.

### *BASIX Distribution and Marketing*

BASIX has extensive local distribution networks, because it also provides microfinance loans to households in villages where the insurance product is marketed. The insurance product was piloted in 2003 in two villages in Mahbubnagar; it was expanded to 43 pilot villages in Mahbubnagar and Ananthapur in 2004.

BASIX used four criteria to determine whether a village was suitable for insurance marketing in 2004: the presence of existing BASIX customers (to ensure some degree of trust in the institution); 200–300 acres of groundnut or castor crops; a reasonable number of farms with 2–10 acres of land; and a village location within 20 kilometers of the nearest rainfall reference station (to minimize basis risk). Because of time constraints, BASIX offered insurance in only a subset of villages meeting these four criteria.

BASIX's strategy was to first explain the insurance product to a trusted opinion leader, who then functioned as a motivator, informing other

TABLE 1. Terms and Payouts of Rainfall Insurance Contracts in Mahbubnagar District, Andhra Pradesh, 2004

Mandal (county)	Premium per acre (rupees)	Phase <sup>a</sup>	First trigger level (millimeters)	Payout per millimeter deficient rain (rupees)	Second trigger level (millimeters)	Maximum lump-sum payout (rupees)	Actual rainfall (millimeters)	Actual payout per acre (rupees)
Atmakur	250	1	60	10	25	1,500	94.2	0
		2	100	15	5	2,000	90.0	150
		3	75	15	30	2,500	184.0	0
Mahbubnagar	150	1	60	10	20	1,500	31.0	290
		2	100	15	50	2,000	96.0	60
		3	75	15	50	2,500	171.0	0
Narayanpet	200	1	60	10	20	1,500	12.0	1,500
		2	100	15	40	2,000	84.0	240
		3	75	15	50	2,500	177.0	0

<sup>a</sup>Phase 1: June 10–July 14; phase 2: July 15–August 28; phase 3: August 29–October 12.

Source: Authors' analysis based on 2004 ICRISAT and World Bank survey data and Indian Meteorological Department rainfall data.

households about the product and a marketing meeting to be held a few days later. BASIX provided a general introduction to the insurance product at the marketing meeting. Policies were sold at the meeting and at individual visits to interested households following the meeting. BASIX agents generally spent one day in each village to market and sell the product.

BASIX representatives ascribed differences in insurance take-up rates across pilot villages to the choice of motivator (particularly the motivators' understanding of the product and their status in the village), the extent of BASIX's market presence, the number of rainy spells before the day of marketing, whether it was raining on the day of marketing (it being hard to sell rainfall insurance on a rainy day), and the liquid assets of farmers on the day of marketing. These factors varied substantially. In some villages farmers had just received payments for their milk delivery and therefore had cash on hand; in other villages, particularly in Ananthapur, government subsidies for groundnut seeds had recently been made available, and most farmers had spent their savings purchasing seeds.

Based on feedback from farmers and BASIX field agents, the rainfall insurance contract design was refined in two important respects between 2004 and 2006. First, separate castor and groundnut policies were combined into a single policy for each rain gauge, to simplify marketing and appeal to farmers growing other crops and to improve benefits for policyholders. Second, the start of the first phase was changed from a fixed calendar date (June 10) to the date by which at least 50 millimeters of rain had fallen since June 1.

Giné, Townsend, and Vickery (2007) present more information on the 2006 contracts and analyze the statistical properties of contract returns by constructing a time series of putative insurance returns using historical rainfall data. They find that the insurance policy insures primarily against severe rainfall events, paying out a positive return in only 11 percent of phases and providing a maximum rate of return of about 900 percent.

In 2003 rainfall insurance was sold to 148 farmers in two villages, mostly to members of borewell users associations.<sup>2</sup> The number of purchasers rose to 315 farmers across 43 pilot villages in 2004. Policies sold covered 570 acres of crop, insuring Rs 3,409,200, equivalent to Rs 10,822 per farmer (about \$240). (For a table showing insurance participation in 2003–04 across survey *mandals*, see section S3 of the supplemental appendix.)

### III. DETERMINANTS OF INSURANCE PARTICIPATION: THEORETICAL PREDICTIONS

What does economic theory predict regarding the determinants of insurance market participation? In a simple setting without asymmetric information, a

2. A borewell user association is a group of households that jointly use and maintain a water bore or set of bores.

household's willingness to pay for an insurance contract will be increasing in risk aversion, the expected insurance payout, and the size of the insured risk and decreasing in basis risk (in other words, increasing in the correlation between the insurance payout and the risk to be insured or, more generally, the household's consumption risk). This is referred to in the remainder of this article as the benchmark model of insurance participation.<sup>3</sup>

Many households remain uninsured against significant income risks (many U.S. households do not have health insurance, for example). Deviating from the full-information benchmark, a large body of literature has considered adverse selection and moral hazard as potential explanations for barriers to trade in insurance (see, for example, Abbring, Chiappori, and Pinquet 2003; Cawley and Philipson 1996; and Rothschild and Stiglitz 1976). Empirical evidence for asymmetric information models of insurance is mixed. For example, Cawley and Philipson (1996) find that conditional on observables, life insurance premia are decreasing in the quantity of insurance purchased, a result that it is at odds with the separating equilibrium in Rothschild and Stiglitz (1976).

Models of adverse selection and moral hazard are of limited applicability to the rainfall insurance contract studied here. Historical rainfall patterns at *mandal* rain gauges are public information, ruling out adverse selection, while moral hazard presents a problem only to the extent that households tamper with the measurement of rainfall at the gauge. There is no evidence suggesting that this is a problem in practice: a World Bank representative who has visited Indian Meteorological Department weather stations reports that they are secure, fenced locations and that rainfall measurements are checked for inconsistencies.

Mulligan and Philipson (2003) introduce fixed participation costs to a benchmark insurance demand model. They argue that such costs help account for patterns such as the positive correlation between wealth and insurance participation identified by Cawley and Philipson (1996).

It is not obvious that any significant fixed costs apply in the setting examined here. Administrative loadings are proportional to the amount insured, and there is no discount for multiple policies. It is possible that because insurance policies are indivisible, it may be difficult for poor households to purchase even a single policy. There may also be other, nonmonetary fixed costs, such as the time cost of attending the marketing meeting or the cognitive costs associated with understanding the product.

### *Hypotheses*

Four hypotheses are presented here. Each is tested in the next section.

*Hypothesis 1:* Insurance participation is higher when risk aversion is high, basis risk is low, and the risk to be insured is large.

3. The appendix presents a simple parametric example of this benchmark model for a household with mean-variance expected utility. The model yields a simple closed-form expression for the household's willingness to pay that illustrates the four comparative statics predictions listed above.

This first hypothesis is simply that insurance participation decisions are consistent with the benchmark model described above.

*Hypothesis 2:* Insurance participation is higher when the household's subjective expectation for future rainfall is low.

Historical rainfall patterns are publicly observable, which suggests that households may share common expectations about the distribution of insurance payouts. To the extent that beliefs differ, households that expect lower rainfall would view the insurance contract as having a higher expected return and would therefore be more likely to purchase insurance.

*Hypothesis 3:* Insurance participation is higher when households are less credit constrained (that is, when the shadow value of liquid assets is lower).

Financial constraints potentially play a key role in insurance participation decisions. On the one hand, credit-constrained households may value the reduction in income volatility provided by insurance more highly, because they have less ability to smooth consumption *ex post*. On the other hand, at the start of the monsoon season, when insurance purchase decisions are made, credit-constrained rural households have limited funds with which to purchase seeds, fertilizer, and other materials needed for sowing. Even if such households are risk averse and would benefit from insurance, the shadow value of liquid assets may be extremely high at such times, making the purchase of insurance unattractive.

The intuition of this second mechanism is illustrated through an extension of the benchmark model in the appendix. It considers a household with mean-variance utility, so that in the baseline model risk aversion and willingness to pay for insurance are independent of wealth. The extension assumes that the household has limited funds, which can be used to purchase insurance or invest in sowing. Willingness to pay for insurance is unambiguously lower when credit constraints bind; within that region it is uniformly increasing in wealth. This result reflects a simple intuition: the more binding are credit constraints, the higher is the shadow value of financial wealth, reflecting the high marginal product of the alternative use of those funds (investment in sowing).

This result may not obtain unambiguously in a multiperiod setting, because credit-constrained households would also place higher value *ex post* on the smoothing of income provided by insurance and because such households are more likely to be constrained at the beginning of future monsoons. (Building a fully specified dynamic model is an interesting challenge for future research.) This suggests that the correct sign of the relation between credit constraints and insurance demand is ambiguous and must be established empirically.

*Hypothesis 4:* Insurance participation is lower when trust in the insurance vendor and understanding of the product is weak and when networks for disseminating information about the product are poor.

The empirical setting also relates closely to the literature on technology adoption and diffusion (Griliches 1957; Feder, Just and Zilberman 1985). This study examines a new financial product: households in the sample have been offered the opportunity to purchase rainfall insurance at most only once previously. Even with the help of the BASIX agent, the household may be uncertain about the contract design or the timing or magnitudes of payouts. Alternatively, the household may not fully trust the insurer to pay out on claims. Although the model is not formally extended to model these factors, three interrelated hypotheses are proposed relating to take-up of a new product that is not well understood by households.

*Hypothesis 4a:* In an environment in which a product is not well understood, households will draw inferences based on the degree of experience and familiarity with the vendor and their trust in it.

*Hypothesis 4b:* Households are likely to rely on information gleaned from social networks, such as whether other trusted farmers also purchase insurance.

*Hypothesis 4c:* Households with greater cognitive ability to understand the product are more willing to experiment with it. Younger and more educated household heads will understand the product more easily and be more likely to purchase it.

#### IV. THE SURVEY

The data come from a household survey conducted after the 2004 monsoon and designed to study households' experiences with ICICI Lombard rainfall insurance. The authors developed the survey questions; ICRISAT conducted the survey in late 2004.

The survey sampling frame is a census of landowner households across 37 villages in Ananthapur and Mahbubnagar. The 25 villages in which at least five households purchased insurance in 2004 were included. The other 12 villages had been identified by BASIX as being suitable for insurance marketing, but no policies had been sold there because of time constraints in the marketing process. Data in these control villages are not used in this paper.

Among the 25 villages, a stratified random sample of households was selected, in order to survey as many purchasers of insurance as possible. Included were all households that purchased insurance (267 households), a random sample of households that attended an insurance marketing meeting but did not purchase insurance (233 households), and households that did not attend a marketing meeting (252 households). The total sample of 752 households was drawn from a population of 5,805 landowning households in the 25 villages. The take-up rate of the insurance product was low, at just 4.6 percent ( $267/5,805$ ), reflecting the short history of the product.

The survey nonresponse rate was extremely low. None of the 267 insurance purchasers refused to participate, and the frequency of nonresponse among nonpurchasers was close to zero. (This in part reflects the fact that the survey was administered after the end of the monsoon, when households were less

busy.) The sample of 267 purchasers represents 85 percent of the 315 households across all villages that purchased rainfall insurance from BASIX in 2004.

In most of the regressions, the dependent variable is *purchased insurance*. As this variable is also stratified, the sampling approach is an example of choice-based sampling. A weighted probit regression is estimated using the sampling weights discussed above to recover consistent estimates of the slope coefficients, following Manski and Lerman (1977).

### *Summary Statistics and Variable Construction*

Full-sample averages are weighted by population and thus are close to non-buyer averages, given the low take-up rate (table 2). For the 25 households for which data are missing for one or more variables, missing values are iteratively imputed as a function of other variables. No single variable is missing more than 11 times; the empirical results are almost unchanged if the sample is restricted to households without missing data rather than imputing missing values. (Full details on the construction of each variable are presented in the supplemental appendix.)

Demographic and wealth data confirm that the sample consists of poor and middle-income smallholder farmers. Mean landholdings are 5.8 acres (median landholdings are 4.0 acres). Household heads have an average of 3.3 years of formal education, although the median household head has no formal education. Nearly all (97 percent) household heads have spent their entire life in the village. Mean household liquid assets—the sum of cash, bank account deposits, jewelry, silver, gold, revolving funds, and miscellaneous liquid assets—are Rs 14,100, equivalent to \$313; median household liquid assets are Rs 8,300 equivalent to \$184).

There are significant differences between the characteristics of insurance buyers and those of nonbuyers. Buyers are less risk averse and report owning about 50 percent more land and nearly twice the liquid assets of nonbuyers. About a third of insurance purchasers but just 4 percent of the population as a whole belong to borewell user associations. At the start of the monsoon 46 percent of buyers but just 7 percent of the overall population had outstanding credit from BASIX. Each of these differences in means is statistically significant at the 5 percent level.

Several variables are intended to elicit parameters of the utility function of the household head. The variable *risk aversion* is measured on a 0–1 scale. It is constructed from a game in which the household head chooses between a series of gambles indexed by increasing risk and return; the household is then given a cash payout of 0–Rs 200 based on its response and the outcome of a coin toss. A related question is used to elicit a dummy variable for ambiguity aversion.

The variable *patience* indicates the proportionate amount a household head must receive today for it to be indifferent to a fixed amount promised in one

TABLE 2. Summary Statistics

Variable	Buyers	Nonbuyers	Level of significance of difference, if any (percent)	Full sample	Standard deviation	Minimum	Maximum
<i>Utility function and beliefs</i>							
Risk aversion <sup>a</sup>	0.733	0.829	1	0.824	0.190	0.000	1.000
Ambiguity aversion <sup>a</sup>	0.507	0.553		0.551	0.498	0.000	1.000
Patience	0.830	0.801	5	0.802	0.135	0.300	1.000
Pessimism about insurance return	0.334	0.308		0.309	0.310	0.000	1.000
<i>Basis risk</i>							
Use accumulated rainfall to decide when to sow <sup>a</sup>	0.052	0.076		0.075	0.264	0.000	1.000
Percent of land used for groundnut	0.216	0.225		0.224	0.348	0.000	1.000
Percent of land used for castor	0.263	0.252		0.252	0.314	0.000	1.000
<i>Credit constraints</i>							
Household is constrained <sup>a</sup>	0.760	0.811		0.808	0.394	0.000	1.000
<i>Leadership/networks</i>							
Member borewell user association <sup>a</sup>	0.345	0.022	1	0.037	0.189	0.000	1.000
“Progressive” household <sup>a</sup>	0.513	0.306	1	0.316	0.465	0.000	1.000
Member Gram Panchayet <sup>a</sup>	0.041	0.016		0.018	0.132	0.000	1.000
Number of other groups household is member of	1.097	0.836	1	0.848	0.745	0.000	4.000
<i>Knowledge of insurance and BASIX</i>							
Past credit from BASIX <sup>a</sup>	0.303	0.030	1	0.043	0.203	0.000	1.000
Has other insurance <sup>a</sup>	0.753	0.553	1	0.562	0.496	0.000	1.000
<i>Income (during monsoon)</i>							
Farming income	55.538	29.605	1	30.801	178.622	0.000	5,621.360
Nonfarming income	3.092	3.096		3.096	3.301	0.000	40.000
<i>Wealth (beginning of monsoon)</i>							
Mean liquid savings (Rs 000s)	22.952	13.500	1	13.936	18.761	0.000	453.000
Median liquid savings (Rs 000s)	14.800	8.000	1	8.000			
Total mean wealth (Rs 000s)	558.668	346.183	1	355.987	504.892	21.400	21,360.500
Total median wealth (Rs 000s)	349.550	228.000	1	232.250			

(Continued)

TABLE 2. Continued

Variable	Buyers	Nonbuyers	Level of significance of difference, if any (percent)	Full sample	Standard deviation	Minimum	Maximum
Landholdings (acres)	8.661	5.663	1	5.801	4.952	0.300	79.500
percent of cultivated land that is irrigated	0.495	0.270	1	0.280	0.405	0.000	2.200
<i>Other variables</i>							
Education of household head (years)	5.301	3.179	1	3.277	4.425	0.000	18.000
Age of household head	43.642	47.060	1	46.902	11.437	21.000	80.000
Head spent whole life in village <sup>a</sup>	0.970	0.971		0.971	0.169	0.000	1.000
Gender of household head (1 = male)	0.936	0.920		0.921	0.270	0.000	1.000
Household size	6.674	6.485	10	6.494	2.808	1.000	17.000
Unweighted number of observations	267	485		752			
Weighted number of observations	267	5538		5805			

<sup>a</sup>A dummy variable where 1 = yes.

Source: Authors' analysis based on 2004 ICRISAT and World Bank survey data.

month's time. The average for this variable is 0.8, suggesting a high monthly discount rate for the households in the sample.

The variable *pessimism about insurance return* measures household pessimism regarding the start of an average monsoon season. Households are asked to assess the probability of the monsoon starting after several different dates. The household head's subjective probability density function for the start of the monsoon is estimated from these responses. The pessimism variable is the area under this density function one standard deviation or more to the right of the historical average start of the monsoon season (a larger value thus represents more weight on a later monsoon start).

The variable *credit constraints* is a proxy for whether the household is credit constrained, based on the household's explanation of why it does not have one more loan. If the household cites a supply-side reason, such as "lack of collateral" or "bank will not give additional loan," this variable is set equal to 1. It is set equal to 0 if the household responds "no need for credit," "do not like to be in debt," or "other."

## V. EMPIRICAL RESULTS

Households that attended a marketing meeting were asked to provide up to three reasons for their decision to purchase BASIX rainfall insurance, ranked in order of importance (table 3). "Security/risk reduction" was the most popular response, followed by "need harvest income"; 65 percent of households cited one of these explanations as the most important reason for purchasing insurance. Responses also indicated the role of networks and learning: "advice from progressive farmers," "other trusted farmers purchased insurance," and "advice from village officials" together account for 19 percent of the weighted responses. Some 12.5 percent of respondents cited either the high expected payout or low premium of the insurance. A small fraction (5.7 percent) of households reported purchasing insurance because of reasons related to "luck."

The most frequently cited reason for not purchasing the product was that the consumer did not understand it (25 percent of weighted responses). Some 21 percent of respondents stated that the household did not have sufficient cash or credit to pay the premium (this finding is consistent with the hypothesis that lack of credit constrains insurance participation). Nearly 24 percent of respondents cited responses related to basis risk ("rain gauge is too far away," "household does not grow castor or groundnut"). Some 16.6 percent of weighted respondents stated that the insurance was too expensive (14.1 percent of respondents) or the payouts too small (2.5 percent of respondents). Only a small percentage of households (2.5 percent) stated they had no need for insurance against rainfall risk.

Many of these qualitative responses match well with the benchmark model of insurance participation under symmetric information: the degree of risk reduction, the expected payout relative to the premium, and the degree of basis

TABLE 3. Self-Reported Reasons for Purchasing Rainfall Insurance (percent of total responses)

Reason	Primary reason	Secondary reason	Tertiary reason	Weighted sum
<i>Reason for purchasing rainfall insurance</i>				
Security/risk reduction	139	53	20	40.1
Need harvest income	25	62	12	15.6
Advice from progressive farmers	17	28	12	8.8
High payout	9	27	11	6.8
Other trusted farmers purchased insurance	16	11	16	6.3
Low premium	17	10	6	5.7
Luck	4	22	21	5.7
Advice from village officials	9	14	3	4.3
Product was well explained	5	9	4	2.7
High percentage of castor	7	2	6	2.3
High percentage of groundnut	4	5	2	1.8
Total	252	243	113	100.0
<i>Reason for not purchasing rainfall insurance</i>				
Do not understand the product	45	59	11	24.9
No cash/credit to pay the premium	58	21	11	21.4
Rain gauge too far away	38	39	9	19.0
Too expensive	32	23	7	14.1
No castor or groundnut	13	6	1	4.9
Do not trust BASIX	5	8	2	3.1
Other	6	7	0	3.0
No need	6	4	1	2.5
Payouts too small	3	7	4	2.5
Dislike insurance	4	7	1	2.5
Purchased in 2003 but not satisfied	2	1	0	0.8
Purchased in 2003 but no payout	2	1	0	0.8
Cloud seeding promised by government	0	1	3	0.5
Total	214	184	50	100.0

Source: Authors' analysis based on 2004 ICRISAT and World Bank survey data.

risk are important factors households consider when making purchase decisions. Two types of responses are inconsistent with the benchmark model. First, a significant proportion of households that purchase insurance do so on the advice of trusted farmers or village leaders; conversely, 25 percent of non-purchasers cite a lack of understanding of the product. Second, a significant proportion of nonpurchasers cite a lack of liquid funds or credit to pay for the premium, suggesting the importance of credit constraints.

### *Regression Estimates*

A reduced-form probit regression model of insurance participation is estimated. The dependent variable is equal to 1 if the household purchases BASIX rainfall insurance in 2004 and 0 otherwise (table 4).

The first column of results normalizes coefficients to reflect the marginal effect of a one-unit change in the explanatory variable on the probability of insurance purchase. For expository purposes, in column 2, the same results are provided after dividing the coefficients by the population mean participation rate of 0.046; these coefficients indicate the percentage change in the probability of take-up for a one-unit shock to the relevant covariate (a coefficient of 1 indicates that a one-unit shock to the explanatory variable doubles the probability of insurance participation for a household whose initial participation probability equals the population average).

*Benchmark model (hypothesis 1).* A first prediction of the benchmark model is that insurance participation is decreasing in basis risk between payouts and household income and increasing in the size of the risk to be insured. Coefficients in table 4 under basis risk appear consistent with these predictions. In particular, two variables are included that measure the proportion of cultivated land used for castor and groundnut the previous year. As these are the two crops against which policies are written, the basis risk from using insurance to hedge rainfall risk is presumably lower when these crops predominate. Consistent with this prediction, the signs on both *percentage groundnut* and *percentage castor* are positive, and both are statistically significant at the 1 percent level. The coefficients in column 2 show that for a household at the population take-up probability of 0.046, moving from growing no groundnut to growing all groundnut increases the probability of purchasing insurance in 2004 by 59 percent (34 percent for castor).

A caveat on these findings is that crop choice is endogenous and there is no econometric instrument for the crop types grown. It is thus possible that an omitted third factor drives both the percentage of castor and groundnut grown and the decision to purchase insurance. For example, progressive or informed farmers may be more likely to grow high-yielding cash crops and more likely to purchase insurance. An alternative variable for measuring basis risk would be distance to rain gauge or some other direct measure of the difference in weather between the farm and the weather station. This approach was not adopted here, because only a small number of villages is studied and because

TABLE 4. Baseline Estimates

Estimate	Marginal effects	Marginal effects scaled by population take-up rate
<i>Utility function</i>		
Risk aversion	-0.011 (1.84)*	-0.246 (1.84)*
Ambiguity aversion	-0.000 (0.07)	-0.004 (0.07)
Patience	0.009 (0.95)	0.193 (0.95)
<i>Beliefs about return on insurance</i>		
Pessimism about insurance return	0.004 (1.19)	0.094 (1.19)
<i>Basis risk</i>		
Use accumulated rainfall to decide when to sow	-0.000 (0.05)	-0.005 (0.05)
Percent cultivated land used for groundnut	0.027 (3.40)***	0.595 (3.40)***
Percent cultivated land used for castor	0.016 (2.84)***	0.338 (2.84)***
<i>Wealth and credit constraints</i>		
Log (wealth in rupees at start of monsoon)	0.004 (1.19)	0.079 (1.19)
Log (landholdings, start of monsoon)	0.002 (0.70)	0.054 (0.70)
F-test: wealth and land ( <i>p</i> -value)	0.02**	0.02**
Percent of cultivated land that is irrigated	0.003 (1.12)	0.075 (1.12)
Household is credit constrained (1= yes)	-0.014 (3.29)***	-0.299 (3.29)***
<i>Familiarity with insurance and BASIX</i>		
Borewell user association member (1 = yes)	0.368 (4.70)***	7.996 (4.70)***
Credit from BASIX (1 = yes)	0.066 (4.83)***	1.438 (4.83)***
Has other insurance (1 = yes)	0.003 (1.35)	0.074 (1.35)
<i>Technology diffusion/networks</i>		
Progressive household	0.007 (2.12)**	0.144 (2.12)**
Member Gram Panchayat	0.081 (2.87)***	1.759 (2.87)***
Number of other groups household is member of	0.007 (3.51)***	0.161 (3.51)***
Number of well-known households	0.000 (0.36)	0.003 (0.36)
Number of well-known households that bought insurance	0.006 (5.06)***	0.124 (5.06)***
<i>Other covariates</i>		
Log (education of household head in years)	0.001 (1.09)	0.029 (1.09)
Log (age of household head)	-0.015 (2.59)***	-0.318 (2.59)***
Household head spent whole life in village (1= yes)	-0.030 (1.79)*	-0.654 (1.79)*
Gender of household head (1= male)	-0.008 (1.37)	-0.184 (1.37)
Log (household size)	0.002 (0.41)	0.035 (0.41)
Village dummy variables	yes	yes
Number of observations	752	752
Pseudo $R^2$	0.44	0.44

\*\*\*Significant at the 1 percent level; \*\*significant at the 5 percent level; \*significant at the 10 percent level.

Note: Numbers in parentheses are robust *z*-statistics. Dependent variable equals 1 if household purchased insurance, 0 otherwise. Weighted probit model. Source: Authors' analysis based on 2004 ICRISAT and World Bank survey data.

village fixed effects, which preclude the use of village-level covariates, are used. Future research by the authors using a much larger sample of villages will include distance to rain gauge.

The second prediction of the benchmark model is that risk-averse households have a higher willingness to pay for insurance. The results, significant at the 10 percent level, show that risk-averse households are marginally less likely to purchase rainfall insurance. Shifting the risk-aversion parameter from its minimum to maximum value (that is, from 0 to 1) reduces the probability of buying insurance by 25 percent (1.1 percentage points). Possible explanations for this result are explored below.

The regression also includes proxies for two other dimensions of the household's utility function: ambiguity aversion and discount rate. Neither of these variables is statistically significant. However, given that these variables are indirectly inferred, it is likely that this result partly reflects measurement error, leading to attenuation bias and weak power to reject the null hypothesis.

*Heterogeneous beliefs (hypothesis 2).* Households that expect the monsoon to start later will expect a higher payout, because the insurance payout is inversely correlated with rainfall from a fixed calendar date. This measure of pessimism is positively correlated with take-up as predicted; however, it is statistically insignificant. This lack of significance may reflect measurement error in the expectations variable, leading to weak power to reject the null.

*Credit constraints (hypothesis 3).* Credit constraints, equivalent to low wealth, imply a high shadow value of wealth and less willingness to pay for insurance. The baseline regression includes two wealth variables,  $\log(1 + \text{landholdings})$  and  $\log(\text{wealth})$ , both measured at the beginning of the monsoon. Both measures have positive signs, and although neither is individually significant, they are jointly significant at the 2 percent level (see supplemental appendix). These variables are strongly collinear; in an unreported regression excluding  $\log(\text{wealth})$ , the coefficient on land quadruples and becomes statistically significant at the 1 percent level.

The covariates also include a direct proxy for credit rationing, derived from household self-reports about why households do not have one more loan. This coefficient is negative, as predicted, and statistically significant at the 1 percent level. Switching on this variable reduces the probability of take-up by 30 percent (1.4 percentage points).

*Trust, financial literacy, and networks (hypothesis 4).* Qualitative responses suggest that a significant fraction of households did not fully understand the insurance product and that many relied on recommendations from others for insurance participation decisions. Hypothesis 4a posits that households with a greater degree of familiarity with or trust in BASIX, the insurance provider, will have higher participation rates. A dummy variable equal to 1 if the household is a member of a borewell user association was created to test this hypothesis. Historically, BASIX has offered group lending to borewell user associations. In 2003, when it first piloted rainfall insurance, it targeted association members. Members of borewell user associations are more likely to know the BASIX sales representative in the village. Such associations also provide a close-knit network of households that share information and advice.

Membership in a borewell user association has a very large and statistically significant effect on participation decisions: the marginal effects estimates suggest that membership increases the probability of insurance participation by a factor of eight ( $p < 0.01$ ). A second variable indicating whether the household is an existing BASIX borrower at the start of the monsoon also strongly predicts take-up, with BASIX customers 143 percent more likely to purchase insurance ( $p < 0.01$ ). These two variables (along with Gram Panchayat membership) are quantitatively the strongest predictors of insurance participation decisions.

Some evidence suggests the importance of social networks in insurance take-up decisions. Households that are members of the village Gram Panchayat are significantly more likely to purchase insurance ( $p < 0.01$ ) than households that are members of other formal and informal village networks ( $p < 0.01$ ), such as self-help groups, Raithu Mitra groups, and caste committees. A variable that measures the number of other well-known households in the respondent's self-identified primary social group that purchased insurance is positive and statistically significant ( $p < 0.01$ ): one additional purchasing household among the respondent's primary group raises the probability of the household purchasing insurance by 12 percent.

These results and the qualitative responses discussed earlier suggest that social networks and trust in the insurance provider are key determinants of insurance take-up (hypotheses 4b). Caution should be exercised in interpreting these results, however, because of the possibility that the estimates reflect unobserved heterogeneity across groups (see Manski 1993 for a discussion of this problem in the context of measuring local network effects). In particular, the strength of the findings may in part reflect the approach taken by BASIX in marketing the insurance. BASIX first contacted opinion leaders in the village, asking them to help publicize the product and the marketing meeting. BASIX also reached out to existing customers. The intensity of marketing is thus an omitted variable, which is likely to be correlated with networks and prior experience with BASIX.

Because the intensity of insurance marketing is not directly measured, it is not possible to easily disentangle these two explanations. In ongoing research by the authors a randomized trial is being conducted that controls for the type of marketing and information received by households. (Households are visited by an insurance educator and given an opportunity to purchase insurance policies; various features of the household visit are then randomized.) The estimates here should be viewed as preliminary, pending results from this randomized trial. However, the findings in this article certainly appear at face value to be inconsistent with the full-information benchmark model. All households in the village are eligible to purchase insurance, so in a model in which all households are rational and fully informed, the intensity of insurance marketing should have no effect on insurance participation.

Hypothesis 4c posits that households vary in their ability to understand the terms of the insurance product. Self-identified "progressive" households—that

is, farmers whom other villagers ask for advice (perhaps because they are more knowledgeable or intelligent)—are 14 percent more likely to purchase insurance ( $p < 0.05$ ) than nonprogressive households. Also statistically significantly more likely to purchase insurance are households whose heads are younger ( $p < 0.01$ ) or who have lived outside the village ( $p < 0.10$ ). A doubling of the household head's age reduces the probability of insurance purchase by 32 percent, consistent with the hypothesis that the cost of evaluating new products and technologies is lower for younger people.

Surprisingly, education is not statistically significantly correlated with insurance participation decisions. This result contrasts with that of Giné and Yang (2007), who find that in Malawi education increases the effect of weather insurance provision on the decision to take a crop loan by households. A possible explanation for the difference is that households in Malawi had no prior experience with the insurance provider, while most households in the sample studied here were very familiar with BASIX. The household's opinion of, and trust in, BASIX is thus likely to be relatively more important when evaluating the quality of the insurance product. Another possible explanation for the discrepancy in results is that Giné and Yang study not the decision to purchase insurance per se but the effect of insurance provision on the decision to take out a loan. It is also possible that education is measured with error. If this is the case, there may not be sufficient power to detect the relation between education and insurance take-up (the coefficient, although not significant, has the correct sign).

#### *Risk-Aversion Interaction Effects*

A puzzling finding in table 4 is that risk-averse household are less, rather than more, likely to purchase rainfall insurance—the opposite of the result predicted by the benchmark model. A possible explanation for this result is that risk-averse households are also averse to uncertainty about the insurance policy itself and the potential risks associated with it, given their imperfect understanding of the product.

This hypothesis is tested by interacting risk aversion with three dummy variables indicating the household's familiarity either with BASIX or with the concept of insurance: whether the household belongs to a borewell user association, is a BASIX borrower at the start of the monsoon, and holds any other type of insurance. Under the product uncertainty explanation, one would expect the wrong-signed risk-aversion coefficient to be concentrated among households that are unfamiliar with BASIX or insurance. The specification from table 4 is reestimated with these three additional interaction terms together and then one at a time.

The estimates are consistent with the product uncertainty explanation (table 5). Each interaction term has a positive sign, as predicted, and the coefficients are jointly significant at the 5 percent level. The interaction term *Risk aversion*  $\times$  *credit from BASIX* is individually significant at the 5

TABLE 5. Risk-Aversion Interaction Effects

Variable	Combined baseline specification	Interaction terms added individually		
		1	2	3
<i>Interaction terms</i>				
Risk aversion × borewell user association	0.005 (0.25)	0.024 (1.23)		
Risk aversion × credit from BASIX	0.028 (1.74)*		0.032 (2.14)**	
Risk aversion × other insurance	0.008 (0.72)			0.014 (1.18)
F-test [joint significance, p-value]	0.043**			
<i>Underlying variables</i>				
Risk aversion	-0.024 (2.42)**	-0.016 (2.81)***	-0.018 (3.22)***	-0.021 (2.17)**
Borewell user association	0.262 (1.82)*	0.078 (2.84)***	0.344 (4.43)***	0.082 (4.72)***
Credit from BASIX	-0.001 (0.08)	0.064 (4.73)***	-0.003 (0.32)	0.066 (4.92)***
Other insurance	-0.003 (0.32)	0.004 (1.43)	0.003 (1.38)	-0.008 (0.79)

\*\*\* Significant at the 1 percent level; \*\* significant at the 5 percent level; \* significant at the 10 percent level.

Note: Numbers in parentheses are robust z-statistics. Dependent variable equals 1 if farmer purchased insurance, 0 otherwise. Weighted probit model. Coefficients are normalized to display marginal effects. Regression includes same variables as baseline regression results (other results are not displayed).

Source: Authors' analysis based on 2004 ICRISAT and World Bank survey data.

percent level when included alone (column 3) and at the 10 percent level when all three interaction terms are included (column 1). The point estimates imply that for a household in which each interaction term is switched from 0 to 1, the combined coefficient on risk aversion switches from  $-0.024$  to  $+0.017$ . The combined coefficient is not statistically different from zero, however, perhaps because of measurement error in the risk-aversion variable, leading to attenuation bias and weak power to reject the null hypothesis.

A potential source of measurement error is the fact that the risk-aversion variable is measured with respect to a gamble of moderate size. Rabin (2000) argues that risk aversion measured using small gambles is likely to overstate risk aversion applicable to gambles with large payoffs. Using Italian data and exploiting a natural experiment, Bombardini and Trebbi (2007) find a coefficient of relative risk aversion of unity that approximates household behavior for both small and large gambles. Their finding provides support for the approach to measuring risk aversion adopted here. Moreover, it is not necessary to correctly measure the absolute level of risk aversion but only to correctly order the relative degree of risk aversion across households.

### *Conditional Probit*

As described earlier, BASIX follows a two-step procedure in marketing rainfall insurance. Households are first invited to attend a marketing meeting. Households that attend are then educated about insurance and given the opportunity to purchase policies.

The supplemental appendix presents estimates using a conditional probit model that accounts for the two sequential steps of the insurance participation decision. Two equations are estimated. The first is estimated on the whole sample; it has a dependent variable equal to 1 if the household attends the marketing meeting and 0 otherwise. The second is estimated on the subsample of households that attend the marketing meeting; it has a dependent variable equal to 1 if the household purchases insurance (that is, it measures participation conditional on meeting attendance).

In general, the baseline estimates hold in a similar way across both steps. Members of borewell user associations and BASIX borrowers are both more likely to attend the marketing meeting and more likely to purchase insurance conditional on attendance (statistically significant at least at the 5 percent level). This suggests that the high rates of participation among these groups do not just reflect encouragement by BASIX to attend the meeting, as this mechanism alone would generate selection bias to produce negative coefficients on these variables in the second step.

TABLE 6. Average Expenditure on and Maximum Payout from Rainfall Insurance, 2004

Item	Per policy (rupees)	Per policyholder (rupees; based on 1.81 policies per household)	Percent of liquid assets at start of monsoon season	Percent of gross monsoon farm revenue
Insurance expenditure	200	362	1.5	0.7
Maximum payout	6,000	10,860	84.1	35.4

Source: Authors' analysis based on 2004 ICRISAT and World Bank survey data.

### *Other Analysis*

Households on average purchase 1.8 policies, at a cost of Rs 362, corresponding to 1.5 percent of liquid assets at the start of the monsoon season and 0.7 percent of 2004 gross monsoon agricultural revenue (table 6). These numbers are relatively small, consistent with the observation that households are experimenting with a new, imperfectly understood product. (The figures are still non-trivial: in the United States they would be equivalent to expenditure on insurance of \$700–\$1,400 year for a small business owner with annual sales revenue of \$100,000–\$200,000.) Returns on insurance are quite skewed. A maximum payout corresponding to crop failure levels of rainfall across all three phases of the monsoon yields a payout of 35 percent of gross farm revenue for an average household purchasing 1.8 policies.

The large coefficients on members of borewell user associations and BASIX customers raise potential concerns that the strength of other relations may be significantly different across members and nonmembers of the two groups. As a robustness exercise, the baseline results are reestimated on the subsample of households that are not members of borewell user associations or BASIX customers. The point estimates are similar, although the statistical significance of the results is sometimes reduced, reflecting the smaller sample size (results available on request).

## VI. SUMMARY AND CONCLUSIONS

This article describes an innovative rainfall insurance product offered to small-holder farmers in the Andhra Pradesh region of southern India. The preliminary evidence on the determinants of insurance participation it presents highlight two main deviations from a benchmark model of insurance participation. First, credit constraints appear to be an impediment to purchasing insurance. Households with less land and less wealth, as well as households that report being credit constrained, are less likely to participate in insurance. This result is consistent with the extension of a one-period benchmark model of insurance to include financial constraints. Insurance participation is also increasing in wealth in developed countries, a fact attributed to asymmetric information or fixed

participation costs (Mulligan and Philipson 2003). The same result is found in a setting in which these explanations appear unlikely to hold.

Second, a variety of results together suggest that limited familiarity with the insurance product plays a key role in participation decisions. Take-up rates are higher among customers of the insurance vendor (BASIX) and members of borrowwell user associations, who are among BASIX's primary clients. Risk-averse households are less likely to purchase insurance, but only if they are unfamiliar with insurance or with BASIX. Households connected to village networks are more likely to purchase insurance, especially when other members of the household's primary group participate. Respondents who likely have lower cognitive costs of understanding and experimenting with insurance, such as young farmers and self-identified progressive farmers, are more likely to purchase the product. And a significant fraction of households cite advice from other farmers and limited understanding of the product as important determinants of participation decisions.

The finding of the significance of credit constraints has practical implications for insurance contract design. One is that insurance payouts should be made as promptly as possible after rainfall is measured and verified. The survey asked households to identify at which times of the year they are most in need of additional liquid assets; unsurprisingly, households reported being most credit constrained at the start of the sowing season and least constrained in November, when crops are harvested and sold. In 2004 insurance payouts were not paid to farmers until about November. Farmers would benefit if payouts were made available as soon as possible, preferably phase by phase, as each stage of the monsoon is completed. One impediment to early payouts is that the Indian Meteorological Department takes an average of two months to verify rainfall data. ICICI Lombard is setting up a network of automated rain gauges, which should facilitate faster payouts and minimize basis risk.

A second innovation would be to combine insurance with a short-term loan that helps credit-constrained households pay the premium (stated differently, BASIX could offer state-contingent loans). Giné and Yang (2007) study a product of this type. BASIX is reluctant to mix products in this way, because it wants to clearly establish to customers the conceptual difference between insurance and microcredit products.

The insurance product studied here has not yet succeeded in proportionately reaching the most vulnerable households (the poor, credit-constrained households, households that are not members of social networks), which presumably would benefit most from protection against drought. This may partly reflect persistent barriers to trade in insurance, such as credit constraints, but it also may reflect a normal pattern of diffusion of a new product. Early adopters are likely to be households for which the cost of experimenting is low. Participation will then filter through to other households over time.

Morduch (2006) highlights potentially adverse general equilibrium implications of differential rates of insurance participation by rich and poor

households. He suggests that if rainfall insurance is purchased only by the wealthy, such households may have additional income with which to bid up the price of local nontraded goods during periods of low rainfall, making non-purchasers worse off. He also suggests that formal insurance may undermine existing risk-sharing mechanisms by raising the threat point of households that seek to withdraw from implicit risk-sharing arrangements.

Relatively little academic research on microinsurance has been conducted to date. Many important questions remain unanswered. Research is needed to determine the causal effect of rainfall insurance on income and consumption smoothing; the price elasticity of demand for insurance (an important policy question given potential government subsidies on insurance contracts); the interaction between rainfall insurance and existing risk-bearing mechanisms; and the pattern of diffusion of insurance participation over time. In ongoing research, the authors are conducting a randomized field experiment among survey households that should shed light on some of these questions.

#### APPENDIX. A SIMPLE MODEL OF INSURANCE PARTICIPATION UNDER SYMMETRIC INFORMATION

Consider a risk-averse household with quadratic expected utility of  $E[U(c)] = E(c) - \gamma \text{var}(c)$ . (This mean-variance form is consistent with a household with constant absolute risk aversion utility facing normally distributed shocks.) Household income is assumed to be  $y = y^* + e$ , where  $e$  has zero mean and variance  $\sigma_y^2$ . The household has access to an insurance policy that insures against this income volatility  $e$ .

The timing of events is as follows: The household decides whether to purchase insurance. Income is realized (that is,  $e$  is revealed). Insurance payouts if any are made. The household consumes its income  $y$  plus any insurance payout.

The policy costs premium  $p$ . The payout on the insurance is  $r = -e + \mu + u$ , where  $\mu$  is the household's expectation of the average insurance payout and  $u$  reflects basis risk associated with the insurance;  $u$  has mean 0 and variance  $\sigma_u^2$  (if  $\sigma_u^2 = 0$  the insurance perfectly offsets the variability in income caused by  $e$ ). Thus if the household purchases insurance, it consumes  $c = y^* + \mu + u - p$ ; if it does not purchase insurance it consumes  $c = y^* + e$ . Under these assumptions the household's willingness to pay is given by expression (A-1):

$$p_{\max} = \mu + \gamma[\sigma_y^2 - \sigma_u^2]. \quad (\text{A} - 1)$$

Thus the household has a higher willingness to pay if it is more risk averse (higher  $\gamma$ ), the insurance involves a lower basis risk (lower  $\sigma_u^2$ ), the insured risk is larger (higher  $\sigma_y^2$ ), or the expected payout of the insurance is higher (higher  $\mu$ ).

### Credit Constraints

Now consider a simple extension of this model that introduces credit constraints. Assume that farmers begin with wealth  $W$ , which they may use either to purchase insurance or invest in seeds. The investment in seeds determines household income; mean household income  $y^* = f(I)$  where  $I$  is investment in seeds and  $f(\cdot)$  is concave. Households are unable to borrow against their future income to purchase seeds or buy insurance ( $W \geq I + p$ ). Any wealth not used for insurance or seeds is assumed to be stored at an interest rate of zero.

If the household has a high level of wealth, it will simply invest up to the point at which  $f'(I) = 1$ . In this case willingness to pay for insurance is given by equation (A-1). Participation is independent of  $W$ , reflecting the fact that the household has constant absolute risk aversion utility.

In the region where  $W$  is low and credit constraints bind, the household decides whether or not to purchase the insurance and invests all residual wealth in seeds. If the household purchases insurance, investment is  $I = W - p$ , and household consumption is  $c = f(W - p) + \mu + u$ . If the household does not purchase insurance, investment in seeds is given by  $I = W$ , and consumption is  $c = f(W) + e$ . Taking expectations of these two expressions, the household's willingness to pay is given implicitly by

$$f(W) - f(W - p_{\max}) = \mu - \gamma[\sigma_y^2 - \sigma_u^2]. \quad (\text{A} - 2)$$

The left side of the equation is equal to  $\int_{W-p}^W f'(x)dx$ . Because  $f(\cdot)$  is concave,  $f(W) - f(W - p)$  is decreasing in  $W$ . Therefore  $dp_{\max}/dW > 0$ , (that is, the willingness to pay for insurance is increasing in wealth). Also, because  $f'(W) > 1$ ,  $p_{\max}$  is lower in the region in which credit constraints bind than in the region where they do not.

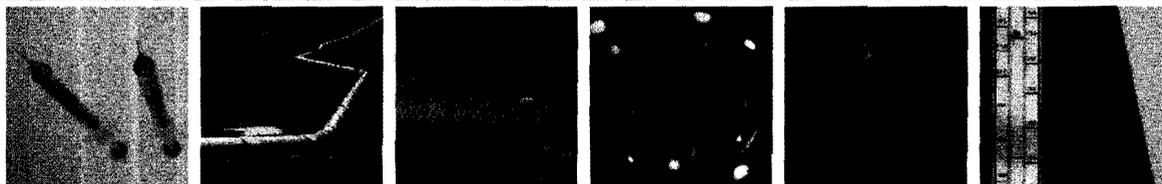
### Summary of Results

This simple model of insurance participation under symmetric information predicts that willingness to pay for insurance will be higher when risk aversion is high (high  $\gamma$ ), the risk to be insured is large (high  $\sigma_y^2$ ), the basis risk is low (low  $\sigma_u^2$ ), the actuarial value of the insurance is high (high  $\mu$ ), and the household is less credit constrained (the shadow value of  $W$  is low).

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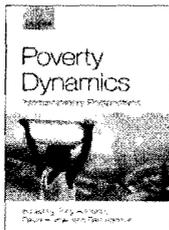
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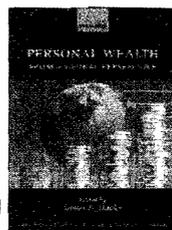
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