ACCESS TO CREDIT AND THE EFFECT OF CREDIT CONSTRAINTS ON COSTA RICAN MANUFACTURING FIRMS

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Abstract[*]

This paper examines the finances and the effect of credit limitations on the behavior and performance of firms in Costa Rica. The study is based on a survey of manufacturing firms conducted by the authors during 2001. The paper characterizes the profile firms' finances, examines the determinants of firms' access to banking credit and tries to assess the effect of credit constraints on the behavior and performance of firms.

The paper finds that while banks are the main source of credit for larger firms, non-banking credit (trade plus informal credit) remains the leading source of funds for smaller firms. Moreover, own funds and informal credit is a leading form of credit for newly created firms. It is also found that the probability of having banking credit and the fraction of banking credit/total debt is mostly affected by (if anything) characteristics of the firm and not by those of their owners. Indeed, the firm's value and age, and whether it keeps formal accounting procedures appear as the most relevant determinants of access to banking credit. With respect to the starting up finances of firms, the data is not conclusive on the determinants of banking credit, yet it suggests a negative relationship with the previous entrepreneurship experience of the owner. The paper discusses different explanations, all of which highlight the importance of credit constraints.

Adopting ideas from the econometric literature on treatment effects, the paper explores the effect of banking credit on the behavior and performance of firms. Two different methods are used to correct for selection biases: a parametric two-step point method and a non-parametric method that estimates upper and lower bounds for the effects. While the results are not statistically conclusive, both methods do suggest that having access to banking credit positively affects firms' performance.

1. Introduction

Economists are familiar with the notion that credit constraints and other credit market imperfections may severely limit the investment and operations of firms. Credit constraints limit the size of firms, as well as their growth, profits, activations and liquidations; their scope of operations may also be limited. Understanding the implications of credit constraints is of first-order importance for the performance of aggregate economies, especially for developing economies, as capital market imperfections can therefore impair the aggregate accumulation of capital, the rate of return of investments, innovations and accumulation.

This paper investigates the existence, the determinants and the consequences of credit constraints for firms operating in Costa Rica. While the existence of credit market imperfections can be self-evident, this paper aims to empirically examine their nature and their relevance. The paper is based on a survey applied to a relatively large sample of manufacturing firms operating in the Metropolitan Area of Costa Rica. Questions covered firms' current finances as well as their sources of funds at the time they were established. On the basis of these data the paper explores the relationship between a firm's finances and its characteristics and performance.

The paper has three main objectives. The first is to analyze and compare the basic statistics on credit across firms with different characteristics, and the second is to identify the characteristics of firms and of entrepreneurs that determine whether they have access to credit from formal financial intermediaries. The third objective is to make progress on the difficult question of assessing the effect of access to formal credit on firms' performance.

A recent study by Monge, Cascante and Hall (2001) explored the institutional arrangements and banking practices present in Costa Rica for enforcing financial contracts. That study documented a rather sophisticated information network among lenders, finding that banks seem to actively screen and keep track of the projects they finance. Interestingly, banks use the value and liquidity of the collateral posted by the entrepreneur as a key criterion for granting credit. In fact, collateral plays a key role in the interaction between the creditor and the borrower, including cases of default and their resolution via civil courts. It was also found that previous experience with borrowers represents another major determinant of banks' decisions to grant credit. In sum, the results reported in that paper suggest some of the main reasons why some entrepreneurs may not receive credit.

Taking a different perspective, this paper examines information on firms instead of banks' behavior. Complementing Monge, Cascante and Hall (2001), this paper examines differences in the sources of funds of firms with different characteristics. Among other things, this information can further an understanding the importance of internal versus external finance as well as the different sources of external finance, in particular, the importance of formal (banking) versus trade credit and informal credit for firms with different characteristics.

Especially relevant is the question of what factors determine whether a firm has access to formal financial markets. It is well known that, typically, credit from formal institutions is less expensive than credit from informal creditors or commercial partners. With these questions in mind, simple and standard econometric methods (Probits and Tobits) are applied to the information that is gathered, with the goal of determining whether any of the characteristics of the firm and of the entrepreneur determine access to banking credit.[1] This question is examined not only in relation to firms' current finances, but also for their reported finances at the time they started operating.

The survey also asked firms to provide different measures of their performance. That information makes it possible to adopt econometric methods from the literature on treatment effects in order to assess the effect of access to bank financing on the performance and behavior of firms. It is necessary, however, to address a key econometric problem: The characteristics of firms that determine their performance may also determine their access to credit from banks. It can be misleading to simply run an OLS including firms with access and without access and estimate the effect of banking credit from the difference in the average on performance measure. To correct for potential *selection biases*, two methods are used. The first is the widely used two-step estimator developed mostly by Heckman (1974 and 1979). The method consists of first estimating the probability of access to credit and then using the predicted value to correct a regression on the performance of the firm. The second method is less well-known, but its application in economics and other social sciences is growing rapidly. This is a non-parametric method, which was mostly developed by Manski (1995) and Manski and Horowitz (1995). The method consists of estimating the worst-case and best-case scenario of the effect of access to banking credit on the performance of firms. The second estimator is more robust but typically

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[1] "Banking" credit also includes credit from savings and loans cooperatives and other quasi-banking financial intermediaries.

less conclusive (less statistically efficient given correct functional form assumptions) than the parametric methods. With the data at hand, the results obtained seem to indicate that access to banking credit has indeed effects on firms' behavior, and itt appears that the effect is stronger on young firms.

It is important to highlight the limitations of this study. Unfortunately availability on data on firms is the major limitation in Costa Rica. That is precisely why the main task for this project consisted in collecting the data. However, only a cross-sectional data base can be recovered, with some retrospective questions on previous dates. The results hinge on the cross-section variation of active firms to identify the effect of credit constraints. The lack of panel data makes it impossible to apply GMM methods to test credit constraints on the investment of firms. Those methods have been discussed and applied with relative success by authors including Jaramillo, Schiantarelli and Weiss (1996) and Schiantarelli (1996).

The remainder of the paper is as follows. Section 2 reviews the economic models of credit constraints, and Section 3 reviews the banking credit and banking practices found in Costa Rica. The subsequent section provides the background information on the manufacturing sector in Costa Rica. Section 4 describes the survey that was conducted and the sample of firms, and Section 5 presents the methods used to single out the key determinants of access to formal credit. The sixth section discusses econometric strategies to isolate the effect of credit constraints on firm performance and present the results, and Section 7 concludes. The appendix contains tables and figures not included in the main text.

2. Credit Constraints and Firms' Behavior

Early theoretical models of entrepreneurship assume directly that credit contracts for business start-ups and ongoing financing are very limited. For example, in the model of Bernhardt and Lloyd-Ellis (2000), there are no credit possibilities at all. In their economy, the operation and formation of firms has to be funded by entrepreneurs' accumulated savings and firms' past profitability. In other models, the maximum credit agents can obtain to fund their productive ventures is modeled as a direct function of wealth or available collateral. Examples of those models are Evans and Jovanovic (1989), Hart and Moore (1994), and Banerjee and Newman (1991). Some of these models allow trade credit, i.e., funds that are backed by the goods supplied.

More recent studies are much more explicit on the way credit markets work and on the role of private information, contract enforcement and renegotiation in shaping the form of contracts and access to lending. Moral hazard is the incentive problem that has received the most attention. If the bank takes too much of the project's returns it might not be in the best interest of the borrower/entrepreneur to exert much effort or care. Rational lenders, though, would foresee the borrowers' poor incentives and consequently restrict lending.

In general, incentive problems can affect the operation of active firms and not only the establishment of firms. For example, some models predict that because of the incentive problems, firms with different net worth will choose different technologies. Agents who do manage to borrow, as compared with those relying exclusively on savings, may choose technologies or activities with lower variance but lower mean returns. For example, Monge (2001), Morduch (1995), Stiglitz and Weiss (1981), and Lehnert, Ligon and Townsend (1999) all present variations on this argument.

Another branch of the literature focuses on limited contract enforceability as the origin of credit constraints. Dynamic general equilibrium models with limited contract enforcement have been successfully applied for asset prices by Kehoe and Levine (1993), Alvarez and Jermann (2001), for consumption by Krueger and Perri (2001), international capital flows by Kehoe and Perri (2000), human capital accumulation by Lochner and Monge (2002), and firm and job creation and destruction by Monge (2001). In the context of firm financing, the models by Hart and Moore (1994), Albuquerque and Hopenhayn (2001), and Ligon, Thomas and Worrall (2001), the temptation to renege imposes limits on credit. Because the temptation to repudiate and default is a direct function of the net worth of the firm, those models provide explicit predictions on the links between firms' age and size with their growth, survival and profits, as well as the dividends distributed to owners.

Needless to say, these kinds of obstacles to the smooth operation of credit markets can make a difference in occupational choice, and therefore to small firms' levels of activity, their success and their growth. The level of inequality, the overall rate of growth, and the level of employment are all functions of the nature of the credit markets. It easy to see that improvements in credit markets could have beneficial implications for growth, employment, and the distribution of income.[2] Furthermore, in a world where small firms are innovators, these limitations in the

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[2] See for example Banerjee and Newman (1991) and Lehnert (1998).

allocation of credit could severely impair the ability of the whole economy to adopt new technologies and economic activities.

All of the many different incentive problems emphasized by the theory may be of relevance in practice, and this agnostic attitude will guide the interpretation of the findings in this paper.

3. Bank Behavior and the Allocation of Credit in Costa Rica

Before reviewing the information on firms' behavior, it is convenient to review the results in Monge, Cascante and Hall (2001), hereafter MCH, on bank practices in Costa Rica. That work studies the interaction of banks in all the stages of the lending relationship: analysis and approval criteria of loan applications, setting of contractual terms, control, follow-up and enforcement as well as renegotiation in cases of default. These findings are from the point of view of the banking institutions, and the information was obtained from a very detailed questionnaire submitted in 1998 to a sample of intermediaries.

MCH found significant differences in the default rates of financial intermediaries. On one hand, the production activities in Costa Rica are very heterogeneous and the financial alternatives are also very diverse, as there is a large variety of financial intermediaries.[3] Traditionally, public institutions had dominated the allocation of credit as part of the politico-economic model. But the waves of liberalization of the 1980s and 1990s and the structural changes in the economy have given much more room to private banks and intermediaries. Indeed, manufactures and services, the fastest-growing sectors, have relied more on private financing, while public banks remain more specialized in agricultural sectors.

The equilibrium in the credit market equilibrium must determine which types of borrowers obtain credit from which type of lender. Such matching can be vitiated by adverse selection, explaining part of the differences in the performance of banks. Yet, the ultimate determinant of the differences must be found in the credit policies of intermediaries. Table 13 in the Appendix shows the frequency of almost every conceivable control and screening action taken by banks. Any of these actions can in principle yield useful information about the prospects of the project, the characteristics of the borrower and the collateral. The evidence

contradicts the commonly held view of banks as dormant lenders. In fact, the banks in the sample are very active, and measures such as visits to the firm, analysis of the project and the incentives and capacity of repayment of their customers are not uncommon. Obviously, the high frequency of these actions may be due to the regulation of the Superintendency of Banks and the reserves that banks must hold for different risk qualification for loans.

Banks pay particular attention to entrepeneurs' collateral. The overwhelming majority of banks make some assessment of the existence, type, market value and liquidity of collateral, and unsecured lending is almost non-existent. Moreover the reputation of the borrower is also a key element in evaluating an application. Monge, Cascante and Hall (2001) asked about the importance of a variety of criteria in deciding whether to grant the loan, and Table 14 of the Appendix reports the importance of those criteria. All elements related to the warranty put on the project and the solvency and references of the borrower play a critical role.

Monge, Cascante and Hall also find that banks look for information on the entrepreneur from alternative sources. Indeed, the use of credit bureaus is widespread, as indicated by Table 15 in the Appendix. In showing the proportion of banks that use credit bureaus, the table indicates that banks in the Metropolitan area have a greater need for those references, while banks in rural areas have more first-hand information on creditors. The operational characteristics of these bureaus, some of which are shown in Table 16 of the Appendix, is a clear indication of the level of sophistication of the information network available to lenders.

Undoubtedly, the findings of MCH support the relevance of a variety of incentive problems in the different stages of the bank-entrepreneur relationships. Banks devote resources to scrutinizing applications, controlling the development of ongoing projects and enforcing contracts, even at the level of the courts. This paper attempts to complete the picture by surveying a rather large set of firms and obtained information on their behavior and financing characteristics. It is first convenient, though, to provide some background on the manufacturing sector in Costa Rica.

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[3] Formal institutions are composed of three commercial public banks, twenty-three private banks, thirty-five savings and loan cooperatives, seventeen non-banking private financial companies, nine housing mutual funds and three other intermediaries created under special laws.
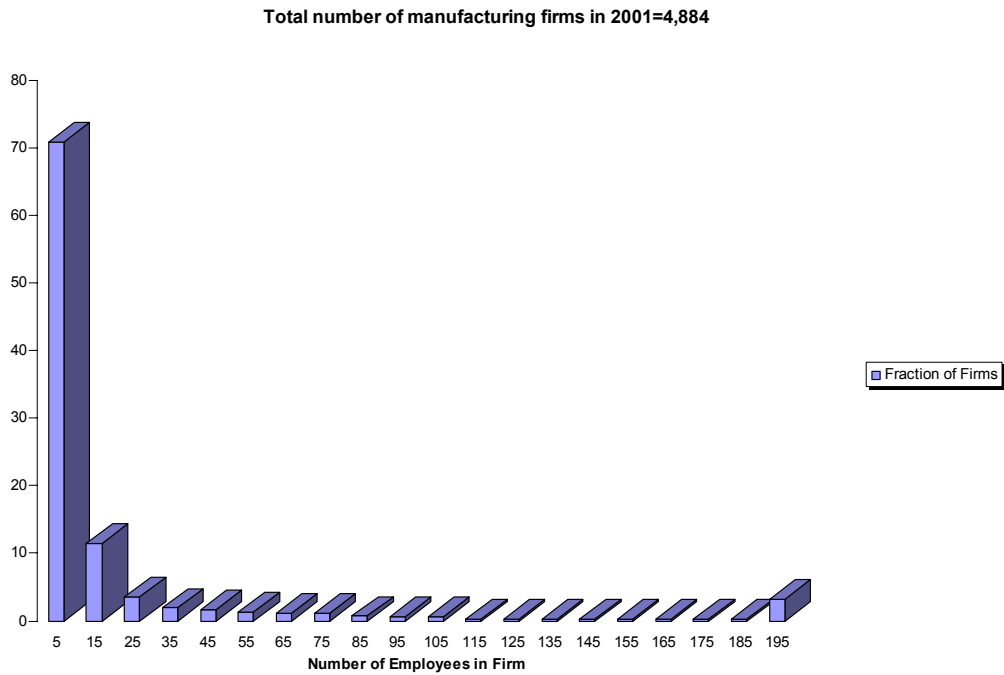
4. The Manufacturing Sector in Costa Rica

The manufacturing sector was selected for several reasons. First, as indicated above, the importance of this sector has remained stable and indeed has increased lately. Second, the available data is better for this sector than for agriculture, services and commerce. Moreover, the sector is largely located in the Metropolitan Area, which made it possible to obtain a representative sample with the limited resources available. Finally, banking credit to manufacturing firms is dominated by private institutions. This suggests that, if there are constraints on credit, they are less likely to be affected by political considerations. Working with this sector is also convenient as the results are more likely to be relevant for the future. Manufactures and private intermediaries are bound to increase their relative importance in Costa Rica.

Table 1. Participation of Manufacturing Sector

	1985	1990	1994	1997	1999
Share in GDP	21.9	21.5	21.8	21.3	27.2
Share in Total Employment	15.6	18.0	17.9	15.6	15.7
Share in Total Exports	28.1	36.5	45.8	47.1	70.7
Share in Exports out of Zonas Francas	*N/A*	*N/A*	29.4	33.8	36.8
Number of formal enterprises	*N/A*	4,463	4,629	5,069	4,884

The manufacturing sector has a strong presence in the Costa Rican economy. During the 1990s, as Table 1 shows, it has averaged approximately 21 percent of GDP and 16 percent of the labor force. These shares have remained generally stable, but in the last two years they have increased partly due to exporting firms. The importance of the manufacturing sector in the exports of Costa Rica is not only significant but has increased and is expected to increase over time. This is true even excluding the firms with special tax treatments (*Zonas Francas*).

Figure 1. Histogram of Active Firms in the Manufacturing Sector: Costa Rica 2000

Total number of manufacturing firms in 2001=4,884

Figure 2. Employment Size of Active Firms in the Manufacturing Sector: Costa Rica 2000

Total Manufacturing Employment in 2001=138,311
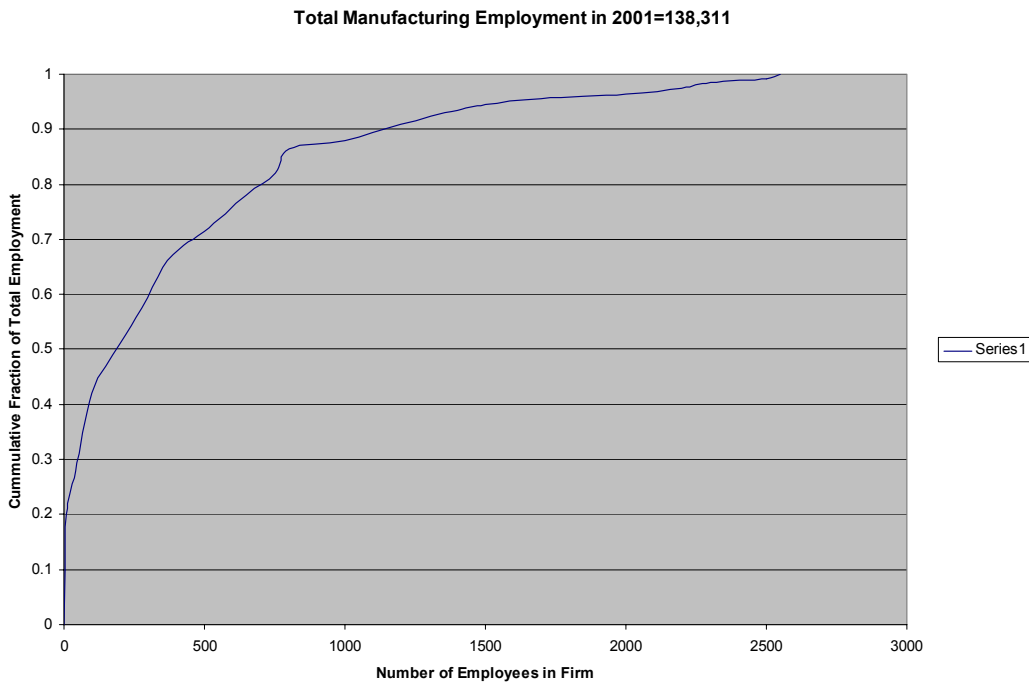
The information in these figures is obtained from the Registry of the Costa Rican Social Security Fund (Caja Costarricense de Seguro Social, or CCSS) for May 2000. The registry will provide the Universe for this paper, and a stratified-random sampling method is used to extract a representative group of firms with different sizes and economic activity. As shown in Figure 4, small firms are a highly relevant segment in the manufacturing sector: of all active firms in 2000, and more than 70 percent have at most 10 employees. There are few large firms. Moreover, as Figure 5 indicates, small firms are also important in terms of employment. Roughly speaking, firms with fewer than 10 employees account for 10 percent of total manufacturing employment; those with at most 50 employees account for more than 30 percent. These figures are significantly higher than in developed economies, as already noted by Ulate (2000), Bolaños and Gutiérrez (1999) and Yong (1988), among others.

Available information on the financing of firms is fragmented and outdated. Most is for large firms registered in the National Stock Exchange or in the Electronic Exchange. This study is consequently based on an original survey that includes both large and small firms and that focuses on different financing decisions. Such a survey will be helpful in understanding the cross section of the firms in the last year. The information will also be linked and compared with the information available, which will be discussed below.

This paper does not make extensive use of the data provided by Coyuntura Industrial a Section of the Instituto de Investigaciones Económicas at Universidad de Costa Rica, which has periodically surveyed the manufacturing sector since 1980, producing a quarterly index of manufacturing activity. While these surveys are rich in terms of production, employment and other indicators, they are inadequate for present purposes for two reasons. First, they do not look into financing conditions. Second, they include mostly larger firms. The most comparable study dates back to 1994, when the U.S. Agency for International Development and the Academia de Centroamérica conducted a survey of the small business sector (commerce, industry and services). The survey, centered on financial aspects of small firms, including their birth, sampled 808 firms with fewer than 20 employees and monthly sales below US$13,000. The results, which are reported in Villalobos (1996), are very suggestive of the financing profile of small firms as well as the determinants of access to formal credit. The results of the survey conducted for this paper are compared with those of Villalobos below.

The results clearly show that small businesses have very limited access to banking credit. Table 2 shows the source of funds for firm births. As clearly indicated, the role of formal credit is very low, less than 14 percent of the funds required to start up a firm. The lion's share of the funds originates from entrepeneurs' personal savings.

Table 2. Start-Up Costs and Ongoing Sources of Financing of Small Business

Start-Up Costs		
Personal		59.5
Friends or Relatives		11.1
Gifts		10.3
Trade Credit		5.2
Formal Credit		13.9
Ongoing Finance		
Personal	All	38.4
	Manufacture	40.0
	Service	33.0
	Commercial	40.2
Trade Credit	All	29.0
	Manufacture	12.8
	Service	23.0
	Commercial	42.4
Advance payments	All	19.1
	Manufacture	30.6
	Service	33.0
	Commercial	4.3

Source: Authors' survey and calculations.

Villalobos reports that as many as one third of the entrepreneurs do not have any access at all to formal credit. For them, the main source of credit is a supplier and/or advance payments by customers. But even those firms with banking credit use banks infrequently and on a small scale. Moreover, firms tend to use only one source of funds, and 70 percent use only one provider of credit. Table 3 shows that formal credit is much lower than commercial credit and

even lower than transfers and loans from friends and relatives. Those results will be compared with the present paper's findings below.

Table 3. Sources of Finance of Small Business with Multiple Providers of Credit

Type	Last 5 years	Last year
Formal	10.6	5.8
Informal	5.8	3.8
Trade Credit	58.7	57.4
Informal Lender	2.8	2.5
Friends and Relatives	10.9	5.9

Source: Villalobos (1996).

5. Firm Survey and the Selection of the Sample

The objective in designing the sample was to depict the financing profile of various types of firms. For firms with 20 or more employees a representative sample was built from 150 firms from the universe of firms used by Coyuntura in the construction of the Index of Industrial Activity. The sample of these "large" firms was stratified according to the different sectors of the Index of Industrial Activity and the number of employees in the firm, and firms from each sector were randomly chosen. Two substitutes were selected for each firm.

A similar sampling scheme was applied to smaller firms (fewer than 20 employees). The universe consisted of the set of manufacturing firms registered in the Social Security Fund (Caja Costarricense de Seguro Social, or CCSS) as of January 2001. A representative sample of 500 firms was extracted from a universe of approximately 5,000 firms, and each selected firm was assigned two substitutes, a step that proved very useful later on. The survey was limited to the Metropolitan Area, which includes the country's main cities (San Jose, Alajuela, Heredia and Cartago) and most of its industrial production.

The survey contained different questions for large, medium and small firms. Conducting the survey involved approximately 2,900 calls, 500 faxes and more than 600 visits to firms. As some of the originally selected firms were closed by the time of the interview, or their phone number was incorrect, the sample of substitutes was extensively used. At the end, with large and small firms, 355 questionnaires were collected. There was a low rate of response for access to

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accounting statements, as many firms considered such information confidential. This is the most stringent limitation on the information collected.

The questionnaire was based on the questionnaires employed by Hall and López (2000) and Hall and Madrigal (2000) for the borrowers of two commercial banks in Costa Rica and the questionnaires used by Bond and Townsend (1996) and Huck, Bond, Rhine and Townsend (1999) for the financing options of minority groups in Chicago and in Thailand.[4]

The information collected can be classified into the following categories:

- **Business general description:** This includes the most basic information on the firms, such as type of activity, location, size of the firm (number of employees, total assets), age of the firm, type of ownership, employees, type of hiring, time of the current owner and tenure of the current management.

- **Business Performance and Financial Conditions:** To investigate the effect of access to credit on firms' performance of firms, information was gathered on production, sales, profits, investments, debt, net worth, and total assets.

- **Human capital and related issues:** Because the characteristics of the manager and/or owner can affect both access to credit and the efficiency of the firm, indicators are collected on education, previous experience in related activities, ownership of other businesses, family composition, and other businesses and occupations.

- **Previous Performance:** Previous performance (i.e., a good or bad record on loans in the past) can determine whether agents would have access to credit. Entrepreneurs were asked about about previous relationships with creditors.

- **Ongoing finance** To identify the main forms of financing by different types of firms, information was gathered on production, sales, size of investments, inventory holdings and other working capital, and payroll. Data was also collected on sources of finance (i.e., internal funds or external finance,

including banks and other formal intermediaries), trade credit, type of relationship with lender (frequency, types of services), suppliers, and informal credit including personal and family sources as well other social networks. One way to learn about whether credit constraints may be binding is to ask a battery of questions such as those in Bond and Townsend (1996) and Huck, Rhine, Bond and Townsend (1999). Included in the survey are questions such as:

1. Would you invest a windfall in your business?
2. Would you be willing to risk all or some of your assets on a new business?
3. Would you be willing to swap part of your firm in exchange for a reduction in debt?
4. Would you like to change the maturity of your debt?
5. Would you like to change some of your trade credit for banking credit?
6. Do you maintain a long-term relationship with a bank?

The idea of including these qualitative indicators is to extract information that would not be available even if ideal information from firms' financial statements were available. For example, investing a windfall in one's business would indicate that there are productive investments available to the entrepreneur. If he would invest, it means that at the very least the expected return on those investment is above the market interest rate. (One must acknowledge though, that the answer to this question may not be as telling in an environment such as Costa Rica, where there is a high spread between deposit and lending rates.) The second question serves a similar purpose. Here, however, risk-aversion and not necessarily credit constraints could be the factor. Yet, with a complete-markets (Arrow-Debreu) economy as a benchmark, risk-aversion would not be an issue, as agents can fully insure; investment and consumption decision would be separated in those cases. Anyway, the answers to these questions could be invalidated by issues of risk aversion due to the lack of insurance. Questions 3 and 4 attempt to investigate whether the composition of liabilities is directly affected by the lack of

some markets or lack of access to them. A similar objective drives question 5, which is specifically geared to banking credit.

- **Start-up finance:** As indicated above, it is also worthwhile to investigate credit rationing in the entry (extensive) margin. Questions like those stated above can be asked but applied to the date when the firm is activated or purchased. Information is collected on the firm's financing at the time of its establishment. As in Bond and Townsend (1996) and Huck, Rhine, Bond and Townsend (1999), the questions used will distinguish new firms from those acquired by the entrepreneur.

- **Shocks and Insurance:** Finally, the survey includes a battery of questions regarding the possibility of using credit to shield the firm in case of sudden needs of liquidity, business opportunities and other shocks.

6. Financing Profiles

Perhaps the first thing one notices by looking at Tables 4-7 is that banks do not provide the majority of credit. Indeed, their participation in financing start-up of firms is very scant. Capital for the industrial sector is mostly obtained from entrepreneur's own funds. Firms with larger value or larger employment exhibit a larger co-participation of partners. Both sources of funds add up to roughly 75 percent of total initial needs, while only 14 percent of start-up capital is provided by banks. For ongoing firms, however, banks provide 48 percent of total debt. Notice that while banking remains the single most important source, trade and informal credit jointly outdo banks. These two sources account for 42 percent and 10 percent, respectively, of the average credit of ongoing firms. With some variation, the pattern holds for other firms. Older firms, as well as firms with higher value and larger employment, finance their activities with a larger portion of private banking credit and a lower share of trade credit and informal credit than their counterparts.

The tables report simple averages of debt composition over the total number of firms. Moreover, firms were grouped according to three different characteristics: age, number of employees and the reported value of the firm. According to age, firms are classified as young,

mature and old as the firms age varies between 0 to 10 years, 11 to 25 years and more than 25 years', respectively. For employment, firms were grouped into those with fewer than 10 employees, 10 to 20 employees and more than 20 employees. Finally, 50 million colones (approximately US$1.67 million at the time of the survey) was used as the dividing line between firms with higher and lower value. Slight variations in the cut-off points did not affect the numbers in a significant way.

Tables 5 and 7 present the number of firms that had employed at least once this source of funding at least once. Then, ratios are computed dividing the number of firms that use this source of funding at least once by the number of firms that report having employed funding. In grouping the firms by age, number of employees and value of the firm, these figures were divided by the number of firms within each group. The two tables report only on the extensive margin of financing. It is interesting that a similar picture arises if the percentages of debts with the fractions of firms using each type of source are considered.

6.1   Startup Capital

In general, older firms as well as larger value and employment firms present a different strategy to finance their startup capital, which combines not only the entrepreneur's own resources (33 percent) but also partners' resources (38 percent). In contrast, younger firms as well as low value and low employment units base their funding on entrepreneurs' own resources (50 percent) and partners' funds are used in only 22 percent of the cases. Banking credit in the initial development of the firm represents only 14 percent of total start-up capital, and there is not a major difference between firms when they are grouped by age, employment or value. A minor difference is observed when Cooperativas, banking firms specialized in individuals, are taken into consideration. Cooperativas account for 5 percent and 8 percent of the start-up capital of smaller and medium-size firms, respectively, but only 2 percent of the start-up capital for larger firms.

6.2   Ongoing Finance

Firms finance their ongoing activities primarily through banks and suppliers. The banking sector represents on average 48 percent of firms' total ongoing finance, while suppliers provide 42 percent. The informal sector finances 10 percent of total resources. When the sample is

decomposed by the age of the firm, number of employees and value of the firm, some important points deserve to be mentioned. In particular, the role of private banking credit increases considerably as the sample moves to older firms, firms with a larger number of employees and firms with larger value. Moreover, firms with larger value and a larger number of employees use less trade credit than their counterparts, as well as less informal credit.

These general findings can be considered in greater detail. For the distinction by age, as firms grow older they increase their use of the banking sector and reduce informal financing. In particular, the use of private banking increases from 7 percent to 25 percent when firms move from Youth to Old Age, and the informal sector's share declines from 16 percent to 3 percent. In the case of trade credit, a u-shaped curve is observed over time; Youth and Old firms have a larger participation of trade credit in total financing than mature firms. In relation to the number of employees, as the number of employees increases, financing by means of banking credit tends to be higher. This result is especially strong for the case of private banking credit, which moves from 4 percent to 33 percent.

In contrast, informal and trade credit are less used as the number of employees increases. For instance, the informal sector averages 17 percent in small firms while it is only 3 percent in large ones. Trade credit declines from 49 percent to 30 percent as the number of employees increases. Finally, for the case of the value of firms, as the value of firms rises private banking credit is more utilized than trade credit. The private banking credit sector finances 3 percent of the activities of firms with low value, while it finances 22 percent for larger valued firms. The values are 52 percent and 33 percent, respectively, for the case of trade credit.

Table 4. Start-Up Debt Composition for Industrial Firms

		Firm Age			Employees			Firm Value	
Start Up Finance Composition									
Variable	Average	Young	Mature	Old	Less 10	From 10 to 20	More 20	Less 50 million	More 50 million
Banking Credit	14.0	12.0	14.0	1.0	13.0	16.0	12.0	15.0	14.0
Private lender	1.0	2.0	2.0	1.0	1.0	3.0	1.0	2.0	1.0
Governmental Program	1.0	2.0	1.0	0.0	1.0	0.0	1.0	1.0	1.0
Relatives	3.0	1.0	3.0	3.0	1.0	4.0	4.0	3.0	4.0
Suppliers and Clients	2.0	1.0	.0	1.0	3.0	2.0	1.0	3.0	2.0
Cooperative	6.0	5.0	8.0	2.0	6.0	6.0	4.0	7.0	3.0
Total Loans	**26.0%**	**23.0%**	**31.0%**	**23.0%**	**26.0%**	**31.0%**	**23.0%**	**30.0%**	**24.0%**
Presents	4.0	6.0	2.0	7.0	5.0	5.0	3.0	5.0	2.0
Personal Resources	**44.0%**	**50.0%**	**47.0%**	**33.0%**	**51.0%**	**51.0%**	**23.0%**	**49.0%**	**31.0%**
Partners	**25.0%**	**22.0%**	**21.0%**	**38.0%**	**19.0%**	**14.0%**	**51.0%**	**17.0%**	**42.0%**

Table 5. Percentage of Firms using Alternative Sources of Start-Up Finance

		Firm Age			Employees			Firm Value	
Percentage of Firms									
Variable	Average	Young	Mature	Old	Less 10	From 10 to 20	More 20	Less 50 million	More 50 million
Banking Credit	19.9	15.2	17.4	17.0	17.0	16.0	10.4	21.1	14.9
Private Lender	2.4	2.9	2.1	0.9	1.3	3.0	1.7	3.0	0.7
Governmental Program	1.0	1.9	0.7	0.0	1.3	0.0	0.9	0.6	1.5
Relatives	4.0	2.9	4.9	1.9	1.9	4.0	3.5	3.6	4.5
Suppliers and Clients	3.4	3.8	3.5	0.9	3.8	2.0	0.9	4.2	2.2
Cooperative	7.7	7.6	9.0	1.9	7.5	6.0	3.5	9.6	3.0
Total Loans	**35.0%**	**28.6%**	**35.4%**	**21.7%**	**29.6%**	**31.0%**	**20.0%**	**39.2%**	**23.9%**
Presents	5.4	5.7	2.8	5.7	5.7	5.0	1.7	6.6	2.2
Personal Resources	**53.2%**	**53.3%**	**50.0%**	**28.3%**	**57.2%**	**51.0%**	**20.0%**	**57.8%**	**28.4%**
Partners	**30.0%**	**23.8%**	**22.2%**	**30.2%**	**20.1%**	**14.0%**	**37.4%**	**19.3%**	**37.3%**

Table 6. Ongoing Finance Composition

		Firm Age			Employees			Firm Value	
								Ongoing Finance Composition	
Variable	Average	Young	Mature	Old	Less 10	From 10 to 20	More 20	Less 50 million	More 50 million
Banking Sector	48.0%	35.0%	53.0%	53.0%	34.0%	43.0%	67.0%	34.0%	57.0%
Public Banks	20.0	12.0	28.0	16.0	17.0	25.0	20.0	19.0	19.0
Private Banks	14.0	7.0	11.0	25.0	4.0	3.0	33.0	3.0	22.0
Other Formal	14.0	16.0	14.0	11.0	13.0	15.0	14.0	13.0	17.0
Informal Sector	10.0%	16.0%	12.0%	3.0%	17.0%	10.0%	3.0%	14.0%	10.0%
Relatives	6.0	8.0	8.0	2.0	10.0	7.0	1.0	8.0	6.0
Other Informal	4.0	8.0	3.0	1.0	6.0	3.0	2.0	6.0	4.0
Suppliers	42.0%	49.0%	35.0%	44.0%	49.0%	47.0%	30.0%	52.0%	33.0%

Table 7. Percentage of Firms using Alternative Sources of Ongoing Finance

		Firm Age			Employees			Firm Value	
								Percentage of Firms	
Variable	Average	Young	Mature	Old	Less 10	From 10 to 20	More 20	Less 50 million	More 50 million
Banking Sector	60.0%	37.0%	45.0%	43.0%	28.0%	43.0%	61.0%	32.0%	59.0%
Public Banks	27.8	16.2	23.6	17.9	14.5	24.7	23.5	17.5	23.9
Private Banks	21.0	9.5	11.1	25.5	3.8	6.2	36.5	3.0	29.1
Other Formal	21.4	18.1	14.6	13.2	11.9	17.3	18.3	13.3	21.6
Informal Sector	18.7%	19.0%	15.3%	4.7%	15.7%	17.3%	7.0%	15.7%	15.7%
Relatives	11.1	8.6	10.4	3.8	8.8	12.3	3.5	8.4	10.4
Other Informal	7.9	11.4	4.9	0.9	6.9	6.2	3.5	7.2	6.0
Suppliers	64.7%	51.4%	41.0%	47.2%	42.1%	54.3%	45.2%	47.6%	50.0%

7. Determinants of Access to Banking Credit

As shown in the previous section, access to formal banking credit is far from widespread. While the evidence collected is only for the manufactures sector, but we strongly believe that the results apply in general. Indeed, our results indicate that things have not changed dramatically since the study by Villalobos (1996). As discussed above, the lack of formal banking credit does not involve only intensity of use, as many firms do not use banking credit at all. It seems interesting, and potentially important, to treat the intensive and extensive margins explicitly, and this section does so with simple and well-known econometric tools.

If the objective were only to examine whether a firm receives credit at all, dichotomous Probit models would be sufficient. In such models firms would be classified into two groups: those with some banking credit and those with no banking credit at all. The probability that a firm belongs to either group as a function of the observable characteristics would then be estimated. A Probit model, however, does not make use of all the information available, as it neglects the intensity of use of credit by firms with banking credit. To include that information, a Tobit model is used. The intensity of use will be measured by the share of banking credit in total credit.

To be more specific, let y_i indicate the fraction of debt of firm debt i that is owed to banks; let y_i be an indicator variable of whether the firm has formal banking credit at all (i.e., $y_i=1$ if $y_i^*>0$ and $y_i=0$ if $y_i^*=0$). Finally, let x_i be a vector of observable characteristics of the firm. (All of these variables are obtained from the survey.) It is assumed that the relationship between x_i and y_i^* is given by the simple form

$$y_i^* = \beta'x_i + \varepsilon_i$$

Here β is a vector of parameters and ε_i is the unobserved and random heterogeneity of the firm. A firm will have no banking credit at all if $\varepsilon_i<-\beta'x_i$. Letting f and F denote the p.d.f. and c.d.f. functions of ε, expressions can be written down for the probabilities. The probability that the firm i receives no credit at all is thus $F(-\beta'x_i)$. Thus, if the parameters of β are known, the probability of observing in the sample a firm with given characteristics (y_i,x_i) is $F(-\beta'x_i)^{1-yi}[1-F(-\beta'x_i)]^{yi}$. On the other hand, the probability of observing a firm with characteristics (y_i^*,y_i,x_i) will be given by $F(-\beta'x_i)^{1-yi}f(-\beta'x_i)^{yi}$.

To estimate the determinants of access the maximum likelihood is used, i.e., the

functions: $L_{\text{Pr}obit} = \prod_{i=1}^{N_{Survey}} F(-\beta' x_i)^{1-y_i} [1 - F(-\beta' x_i)]^{y_i}$ and $L_{Tobit} = \prod_{i=1}^{N_{Survey}} F(-\beta' x_i)^{1-y_i} f(-\beta' x_i)^{y_i}$

are maximized by parameter estimates of β.

The variables x_i in this study contain information on the firm (age, assets, employment, type of ownership, total debt, etc) including their industrial sector, as well as the characteristics of the owner or manager (age, sex, education, ownership of a house, previous experience, etc.) and the owner's their response about whether they would like to change their financing profile. Table 8 defines the variables names used below. We will report first the results for the finances of ongoing firms. In the last part of this section, we report the results for the finances of the firms at the time of their activation.

Table 8. Variables Description

Name	Variable Definition
Bankrel	A dummy equal to 1 if the entrepreneur's reports he/ she has a long term relationship with a bank.
Bactdeb	Ratio of total banking credit to total debt.
Bancred	1 if the firm has ongoing banking credit 0 otherwise.
Exastdbt	1 if the owner would exchange assets for lower debt.
Exsupdbt	1 if the owner would exchange supplier debt for banking debt.
Finstat	1 if the firm has accounting statement 0 otherwise.
Ftypown	1 if the firm is stock company 0 otherwise.
Hgsch	1 if the owner has high school education 0 otherwise.
House	A dummy variable with one if the entrepreneur owns a house.
Initdebt	Total start up investment.
LnEmploy	Log. of Employment of the firm.
LnAge	Log. of Age of the owner of the firm.
LnFage	Log. of Age of the firm.
LnFvalue	Log. Of Value of the firm in colones.
Onbkdbt	Total amount of total ongoing debt in colones.
Othinc	1 if the owner reports other sources of income besides the firm.
Prexp	Previous experience. Dummy variable, 1 if the owner had a business before.
Profrate	Profit rate.
Reinvest	Rate of re-investment out of total profits.
Secalim	Dummy variable, equal to 1, if the firm is in the food sector.
Secmad	Dummy variable, equal to 1, if the firm is in the wood sector.
Secmetal	Dummy variable, equal to 1, if the firm is in the metal sector.
Secpapel	Dummy variable, equal to 1, if the firm is in the paper sector.
Secquim	Dummy variable, equal to 1, if the firm is in the chemical sector.
Sectex	Dummy variable, equal to 1, if the firm is in the textile sector.
Sex	Sex of the owner of the firm: 1 if female, 0 otherwise.
Special	If the manager and the owner are different persons.
Startcredt	1 if firm used start up banking credit 0 otherwise.
Startperc	Ratio of start up banking credit to total start up investment.
Unived	1 If the owner has university education 0 otherwise.
Uselott	1 if the owner would invest a lottery prize in the firm; 0 otherwise.

7.1 Results for Banking Credit in Ongoing Finances

Experiments were attempted with many different combinations of the variables obtained in the survey. Here, however, only the most interesting are reported.[5] The purpose is to find out if any of the characteristics of the firm and of the entrepreneur can explain the use of banking credit.

Firm characteristics that are included are the firm's age, size (log-of number of employees) and leverage (total debt/assets). Entrepreneur indicators are his/her age, whether they have other sources of income, owned a house, had previous experience as entrepreneur and the fraction of the firm initially financed by banks.

Estimates are reported for specifications that focus exclusively on the characteristics of the firm, on the characteristics of the entrepreneur and specifications that include both. Specifically, the following four models are estimated. Model 1 includes almost all information on the characteristics of the entrepreneur and of the firm. Model 2 excludes from Model 1 the size of the firm and its leverage; the rationale is that these variables could be better seen as the outcome of access to credit and not a factor responsible for it. Model 3 focuses on the characteristics of the entrepreneur and thus excludes firm characteristics. Finally, Model 4 focuses on firm characteristics. This model also includes the value of the firm as an explanatory variable. While the (self-assessed) value of the firm can be seen as being affected by credit constraints, this variable is included here in order to determine if its inclusion in the regression would affect the results for the other variables, including their value.

Tables 9 and 10 show the results for the Probit and the Tobit models, respectively. In these tables, as well as the subsequent tables, there are two rows for each variable. The first contains the estimated coefficient, while the second contains the t-statistic under the null hypothesis that the coefficient is zero. All the estimations included dummies for the industrial sector of the firm, but they are not be included in the tables for three reasons. First, these dummies are not statistically significant. Second, inter-sector differences per se are not a matter of direct interest for this paper. Third, omitting the dummies keeps the tables at a manageable size.

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[5] The database is available from the authors upon request.

Table 9. Determinants of Access to Credit: Probit Model on Ongoing Finance
(Numbers in the second raw of each variable are the t-statistics under the hypothesis that the coefficient is zero)

Variable	Model 1	Model 2	Model 3	Model 4
Constant	-1.3453	0.4056	0.4664	-7.6305
	-0.642	0.226	0.267	-4.59***
STARTPER	-0.2763	-0.0643	0.0030	
	-0.746	-0.205	0.01	
BANKREL	0.4544	0.4247	0.4120	0.3535
	1.898*	2.055**	2.025**	1.56
FINSTAT	0.4926	0.5239		-0.1009
	1.739*	2.127**		-0.376
LNAGE	-0.3376	-0.5437	-0.4706	
	-0.602	-1.097	-1.021	
LNFAGE	0.2736	0.0418		0.1011
	1.482	0.273		0.632
SEX	-0.2196	0.0670	0.1072	
	-0.611	0.207	0.339	
HOUSE	0.1698	0.3599	0.3527	
	0.485	1.129	1.123	
OTHINC	-0.1081	-0.0196	0.0344	
	-0.432	-0.09	0.16	
FTYPOWN	-0.1925	-0.0854	0.0935	
	-0.694	-0.367	0.43	
LEVER	1.2157			1.6796
	2.571**			3.617***
LNEMPLOY	0.3339			0.0573
	2.754***			0.432
LNFVALUE				0.3558
				3.496***
# Obs	164	189	189	180

* significant at 10%; ** significant at 5%, *** significant at 1%

Table 10. Determinants of Access to Credit: Tobit Model on Ongoing Finance
(Numbers in the second raw of each variable are the t-statistics under the hypothesis that
the coefficient is zero)

Variable	Model 1	Model 2	Model 3	Model 4
Constant	-0.4092	0.1423	0.1471	-3.3700
	-0.247	0.085	0.088	-3.025***
STARTPER	-0.4181	-0.1720	-0.1021	
	-1.408	-0.577	-0.338	
FINSTAT	0.4018	0.4767		0.1041
	1.754*	2.018**		0.474
LNAGE	-0.3643	-0.4590	-0.3597	
	-0.812	-0.987	-0.809	
LNFAGE	0.1655	0.0838		0.0585
	1.211	0.584		0.472
SEX	-0.2662	-0.0358	0.0224	
	-0.92	-0.118	0.074	
HOUSE	0.2210	0.3540	0.3598	
	0.783	1.163	1.175	
BANKREL	0.3791	0.3987	0.3886	0.2179
	1.966**	2.018**	1.953*	1.181
OTHINC	-0.1119	-0.0227	0.0337	
	-0.561	-0.111	0.163	
FTYPOWN	-0.1058	-0.0353	0.1268	
	-0.483	-0.162	0.607	
LNEMPLOY	0.2675			0.1628
	2.767***			1.575
LEVER	0.0246			0.0325
	1.705*			2.064**
LNFVALUE				0.1228
				1.796*
# Obs.	164	189	189	180

* significant at 10%; ** significant at 5%, *** significant at 1%

As can be seen in both tables and in all four specifications, personal characteristics of entrepreneurs do not appear to have a significant effect on either the probability of having banking credit or the share of credit that comes from banks. In all cases, it seems that the age of the entrepreneur has a negative effect, but it is never significant. Consistent with the view that

women may experience greater difficulty in obtaining credit, the estimates on the sex dummy frequently show a negative sign, but it also is never statistically significant. Ownership of a house shows a positive sign, but the result is not significant.

With respect to other income, it is less obvious what sign to expect. On one hand, individuals with other sources of income should have better access to banks. On the other hand, individuals with other sources of income can more easily self-finance. The results obtained, though not significant, would tend to support the second hypothesis.

Potentially more interestingly is that, with the exception of one regression, the percentage of initial capital from banking credit shows a negative relationship with banks' share in the current credit of firms. This may appear odd, as firms that were funded by banks in the first place would seem more likely to maintain an ongoing relationship with banks, and included in the regressions is a dummy variable indicating whether the entrepreneur considers that he or she has an ongoing relationship with banks. However, the negative point estimates remain even if the dummy is not included. In any event, the results are never statistically significant.

Firm characteristics are more significant. Tables 9 and 10 report only the results for the models discussed above. However, many different variations were estimated. The main problem in extracting conclusions from these regressions is the high degree of collinearity among firm characteristics including age, number of employees, and value. All these variable tend to move in the same direction.

Estimating the Probit and Tobit models, respectively, with the probability of banking credit and its fraction over total credit, using only size (number of employees), value or age, as the only explanatory variable, always renders positive and statistically significant estimates. With the exception of firm's age, those results, which are not shown here, are robust to inclusion of the entrepreneur's characteristics. The problem arises when several of these characteristics are included at the same time.

The value of the firm is the most robust predictor of the firm's access to banking credit. Regardless of which of the other variables are included, the estimated effect of value of the firm remains positive and statistically significant. On the other hand, as long as the value of the firm is not included, both the size of the firm in terms of the (log of) number of employees and the dummy of formal accounting procedures have a positive and significant effect. Including the

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value of the firm eliminates both results, an indication that the value of the firm provides the same information.

Model 4 includes leverage in order to control for the total debt of the firm and to study what determines the share that is financed by formal financial intermediaries. The expected sign in all equations is positive, as firms that need more credit would try harder to obtain it from cheaper sources. The point estimates are positive in both, the Probit and Tobit models, but interestingly, they are much more significant in the Probit model. These results suggest that firms in great need of credit will make extra efforts in obtaining it from banks. Alternatively, causality may work in the opposite direction. Firms with access to banks may make more intense use of credit. With the data available it is impossible to distinguish which direction of causality is the most relevant.

A word of warning is in order. As indicated above, "characteristics" such as number of employees, value, use of formal accounting procedures and even type of ownership are all outcomes of the past, current and expected future behavior and performance of the firm, and, obviously, these cannot be assumed to be independent of access to credit. Yet, at any point in time, those characteristics must determine access to banking credit in the period. If panel data were available, it would be possible attempt different identification schemes to estimate the direct effect of those firm's outcome characteristics on their access to banking credit. The lack of panel data on firms, however, is precisely the main limitation encountered in this project.

7.2   Start-Up Finances

It is widely believed that credit constraints are more stringent for younger firms than for older and better established ones. If that is the case, then credit limitations should be the most stringent precisely at entry, i.e., when an entrepreneur starts a new business. Indeed, the previous section finds that banking credit is a significantly more important source of resources for established firms than for newly created ones. In this sense, the evidence is consistent with the view that banking credit is harder to obtain for new firms. As in the previous subsection, the objective now is to investigate which characteristics of firms and of entrepreneurs explain their access to banks. The inherent limitations of using retrospective data, though, must be acknowledged from the beginning. The ideal would be to collect information on firms just entering at the time of the

survey, but a good registry of new firms is not available. Moreover, the small size of the country will likely limit the applicability of statistical methods.

Table 11. Determinants of Access to Credit: Financing the Start Up
(Numbers in the second raw of each variable are the t-statistics under the hypothesis that the coefficient is zero)

Variable	Probit	Tobit
Constant	-1.5203	-1.414
	-2.475***	-2.316***
PREXP	-0.4715	-0.5016
	-1.977**	-2.15**
FINSTAT	0.2267	0.3172
	0.996	1.445
FTYPOWN	0.19	0.1298
	0.833	0.598
HOUSE	0.1972	0.1257
	0.643	0.431
SEX	-0.105	-0.0077
	-0.328	-0.025
SECALIM	0.2758	0.2265
	0.576	0.508
SECTEX	0.6883	0.5337
	1.446	1.194
SECMAD	0.3664	0.2762
	0.72	0.578
SECPAPEL	1.0047	0.8248
	2.064**	1.801*
SECQUIM	-0.0857	-0.3672
	-0.152	-0.664
SECMETAL	0.4017	0.357
	0.874	0.834
Number obs	225	222

* significant at 10%; ** significant at 5%, *** significant at 1%

As with ongoing finances, Probit and Tobit models are used to estimate the share of banking credit as a function of observable characteristics; Table 11 shows some of the results. Many different specifications were tried, involving most of the recorded characteristics of entrepreneurs and firms. Contrary to expectations, though, the variables on the schooling attainment of the owner were never significant; moreover, they tended to change signs depending on the other regressors included. Because of that, it did seem worthwhile to report any estimates

on the owner's education. Moreover, they did not affect the significance of the other variables. Other characteristics of the owner, such as gender or home ownership, were not significant, but the sign of the estimate remained mostly unchanged with the different sets of regressors. Indeed, while not significant, having a house is positively associated with obtaining banking credit. Also, women appear to have more difficulties in obtaining credit. The direction of these results is as expected, but again, the estimates are not statistically significant. The table also shows that in the case of start-up financing, the sector of the firm can significantly affect access to banking credit. This is contrary to the case of ongoing finance, partly because in that instance more characteristics of the firm were included.

The most robust finding is that there is a negative and significant relationship between the use of banking credit and whether the owner had previous experience as an entrepreneur at the time of starting the firm. To some extent this is surprising. One would expect that entrepreneurs with previous experience may have accumulated useful skills and knowledge to successfully manage the new firm. Creditors would be expected to be willing to lend resources if they had a positive estimate of previous experience. A negative, significant effect can be explained by very different reasons, which cannot be determined on the basis of the data collected. One possibility is that previous experience is indicating failures in the past. As such, a bad record as entrepreneur could convey negative information (a stigma) from the point of view of the bankers. An alternative explanation is that banking credit is hard to obtain for young firms but for reasons completely independent of the previous experience (failure or success) of the firm. A negative sign could be explained if previous experience denotes previous successes that allowed the entrepreneur to accumulate the resources necessary for the new firm. Those entrepreneurs would be self-financing their projects, eliminating the need for banks. A third alternative is that entrepreneurs with previous experience may find it easier to obtain credit from other firms in the sector. All these hypotheses remain possible, as the available data do not allow distinctions to be made among them.

8. Credit Constraints and Firm Performance

What is the effect of access to formal banking credit on the behavior and performance of firms? In general, banking credit is less expensive than other types, such as trade and informal credit. Thus, having access to banking credit will affect firms in a variety of margins, ranging from their

profits (and hence their net value) as well as their size and investment decisions. Moreover, credit market frictions also affect the creation, liquidation and growth of the population of firms in the economy.[6] Consequently, better access to credit implies that more small firms will be created and fewer will be destroyed. Firms with better access to credit will grow faster, and active firms will be larger. Thus, in equilibrium, the extent of firms' access to banking credit would enhance the mass of active firms. Still, the implications for the shape of the cross-section distribution of active firms are not easy to determine.

A controlled experiment would provide the ideal method for assessing the effect of access to formal credit markets. Such an experiment would include two large groups of individuals, identical in all respects except for access to formal credit markets. If the two groups could be followed over time, it would then be possible to record and compare firms' size, growth, profits, and investment, as well as their entry (firm activation decisions), exit (firm liquidation) and life span. In such an ideal scenario, one could unambiguously assess the effect of having access to formal markets in all these dimensions of firm behavior, and one could even make strong welfare conclusions.

Of course, such experiments are not available. Yet, thinking of such hypothetical exercises helps to situate the limitations and visualize the potential biases of estimations using actual data. First of all, data are available only on active firms. Indeed, credit-constrained firms are more likely than others to liquidate early, and the lack of good credit alternatives might prevent such firms from being created at all. Credit-constrained firms thus may not be observed at all at the time of collecting the sample. One can hardly imagine a tougher problem than that of predicting how a cross-section of firms would look if financial markets were different!

A more limited objective would be to study the effect of credit constraints on the behavior of *surviving* firms if a set of firms with access to different credit markets could be followed. In this case, omitting survival biases, one would be able to contrast the behavior of investment and other measures of firms' behavior. The main challenge in this case would be to identify variables that determine access to formal banking credit and do not affect the performance of the firm directly. Schiantarelli (1996) discusses panel GMM methods to address this problem specifically, but the aforementioned lack of available panel data on Costa Rica unfortunately makes it impossible to adopt these methods.

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[6] See, for example, Albuquerque and Hopenhayn (2001) and Monge (2001).

Using the cross-section data collected in the survey, this section explores two different econometric methods in an attempt to isolate the effects of credit constraints on the behavior and performance of firms. Of particular interest is the effect of having access to bank credit. The econometric problem that arises is that of sample selection: firms with and without access may be inherently different, and measures of their behavior and performance may determine the extent to which firms have credit.

As made clear by the dynamic limited enforcement models of Albuquerque and Hopenhayn (2001), Hart and Moore (1994) and Monge (2001), the characteristics of firms at any point in time are the result of their previous behavior and access to credit. Those models also imply that the value and (observable) productivity and profits of a firm explicitly determine the credit that they can obtain. Thus, anyone interested in estimating the effect of credit constraints on dimensions of firms' behavior, must necessarily face the identification problem of controlling for the effect of those observable characteristics on the credit received. The following subsection discusses a methodology that imposes functional and distributional form assumptions to explicitly handle the identification problem.

8.1 Effect of Banking Credit I: A Two-Step Parametric Method

The most natural way to assess the effects of having access to banking credit would be to run a simple regression of the form:

$$p_i = \gamma y_i + \beta X_i + \varepsilon_i$$

where p_i denotes alternative measures of interest on the performance of firm i; y_i denotes whether the firm i has banking credit; and X_i denotes observable characteristics of the same firm. Here ε_i indicates random, unobserved heterogeneity.

While intuitive, such an approach will not necessarily render consistent estimates of γ, the effect of access on the performance on the firm. At the very least, one must recognize that one does not observe a purely *random* sample of (p_i, y_i, X_i). To see that, imagine that there is a set of firms with the same characteristics X_i, and randomly some firms are allowed to have credit $(y_i = 1)$ and others are not $(y_i = 0)$. Under these circumstances, one could consistently estimate the effect of credit by the difference in the estimated means of the performances. Now, if there are firms with different characteristics X_i, as long as the sampling is random, OLS will consistently

estimate the effect of credit. The problem is that having access to banking credit is indeed the result of a market equilibrium, and, as such, it is quite possible that a set of variables affects both firm performance and access to credit. Using the previous equation, the problem is that whether a firm has credit may depend on $(X_i \; \varepsilon_i)$. Clearly, the key problem is that there is no way to observe the counterfactual performance that firms that received credit would have displayed if they had not had no access. Also, there is no way to observe the performance that firms with no credit would have displayed if they had enjoyed access to it. This problem could be solved if such a counterfactual could be estimated.

This *sample selectivity* problem is well known in the economics literature. This subsection adopts a strategy originally developed by labor economists, most notably Heckman (1974 and 1979). Consider having a sample of firms, a cross-section, (p_i, y_i, X_i, W_i) where, as before, p_i indicates some measure of performance, y_i indicates whether the firm has banking credit, and X_i, W_i are vectors of observable characteristics of the firms.

As before, assume that

$$p_i = \gamma y_i + \beta X_i + \varepsilon_i$$

It is also assumed that the condition of whether a firm has access is given by an index model. There is a latent variable y* given by

$$y_i^* = \alpha W_i + v_i$$

where v_i is a random component. Whether a firm has banking credit or not is given by

$$y_i = \begin{cases} 1 & \text{if } y_i^* > 0 \\ 0 & \text{otherwise} \end{cases}$$

In order to parametrically estimate the model, Heckman assumes that (ε_i, v_i) are j*ointly normally distributed*, with means zero, and variance-covariances given by $\sigma_\varepsilon^2, \sigma_v^2, \rho \sigma_\varepsilon \sigma_v$ for some $\rho \in [-1,1]$. Under these assumptions, one can compute the conditional expectations of the performance of the firms with and without access. Indeed, the mean performance, conditional on having credit and the observable characteristics of the firms is

$$E[p_i \mid X_i, y_i = 1] = E[p_i \mid X_i, \alpha W_i + v_i > 0]$$

$$= \beta X_i + \gamma + E[\varepsilon_i \mid X_i, \alpha W_i + v_i > 0]$$

$$= \beta X_i + \gamma + (\rho \sigma_\varepsilon \sigma_v)[\phi(\alpha W_i) / \Phi(\alpha W_i)]$$

where ϕ and Φ are, respectively, the pdf and cdf functions of a standard normal. The last line follows from the normality assumption. A similar expression can be obtained for $E[pi|Xi,yi=0]$.

Thus, if the value of the parameter α were known, it would be possible to simply add the term $\lambda_i = [\phi(\alpha W_i)/\Phi(\alpha W_i)]$ in the right hand side of the equation. In this way, consistent estimates of (γ, β) would be obtained. The problem is that the exact value of α is not known.

This discussion suggests a method for estimating the model, precisely because one can consistently estimate α by simply estimating a Probit (which, again, is warranted, given the normality assumption). This is precisely what the methods advocated by Heckman and others do. First, estimate α via maximum likehood on a probit. Second, obtain the values for λ_i, i.e., the inverse Mill's ratios (ϕ/Φ) for each firm of each type, firms with and without formal banking credit. Third, using the observations on *all* firms, estimate the performance equation.[7]

8.1.1 Results

The previous methods are applied to estimating the effect of banking credit on several measures of performance. Here it must be emphasized that separating *exogenous* characteristics and measures of behavior and performance is necessarily an arbitrary exercise. All observable characteristics recorded for each firm are derived from its history.

In any event, an attempt is made to determine the effect of banking credit on the following measures of behavior and performance:

- Log of Employment;
- Profit Rate as a fraction of initial net assets;
- Total Investment;[8] and
- Investment as a fraction of net earnings.

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[7] In this last step, one must correct the standard error to account for the fact that an estimate of α has been used instead of its actual value.

[8] We use total investment instead of log of investment to include firms with zero investment.

As exogenous characteristics, these exercises will take the following:

- Firm indicators: age, accounting system, type of ownership;

- Entrepreneur's indicators: age, sex, etc; and

- Dummy variables to control for different sectors.

In all cases, indicators were included of the characteristics of the owner and of whether the firm is managed by the owner or by someone else. The results reported here do not include leverage, as it could be highly correlated with access to banking credit. The results did not change dramatically, however, when leverage was included. The value of the firm was included in neither the performance equation nor the probability equation.

Sector dummies are not statistically significant at conventional levels, and their exclusion from the equations did not change the main results. Table 12 reports the results of the regressions including sector dummies, but the estimates are not included to keep the size of the table small.

Table 12. Banking Credit and Firm Performance
(Numbers in the second row of each variable are the t-statistics under the hypothesis that the coefficient is zero)

Variable	log.Employment		Total Investment		Profit Rate	% Reinvest Earnings	
Constant	3.21		-7.81E+07		0.87	94.16	
	3.07	***	-0.46		0.51	2.26	***
SEX	0.43		-6.63E+07		-0.04	-5.04	
	2.07	***	-2.06	***	-0.11	-0.63	
LNAGE	-0.53		2.83E+07		-0.26	-8.37	
	-1.95	**	0.65		-0.59	-0.77	
LNFAGE	-0.08		-1.73E+07		-0.08	-6.48	
	-0.48		-0.62		-0.29	-0.97	
FINSTAT	0.06		-6.12E+07		-0.72	-20.34	
	0.11		-0.80		-1.02	-1.07	
FTYPOWN	0.20		3.31E+07		-0.03	11.74	
	1.46		1.54		-0.13	2.23	***
BANCRED	2.28		4.23E+08		3.57	107.98	
	1.01		1.22		1.09	1.27	
LAMBDA	-1.08		-2.24E+08		-1.97	-55.61	
	-0.81		-1.08		-1.03	-1.09	
# Obs.	185		173		109	185	

* significant at 10%; ** significant at 5%, *** significant at 1%

Regardless of the specific measure of behavior/performance, to carry out these exercises one must impose assumptions on which variables belong to both the access equation and the performance/behavior equation. Specifically, it is necessary to assume that some variables affect only the performance and not the probability of accessing credit. Many different specifications, some of which were reported in previous versions of the paper, have been explored.

The results reported here are for the case in which the probability of having access to banking credit is specified only as a function of the (log of) age of the firm and whether the firm has formal accounting practices.[9] The previous section found that the use of financial statements and the value of the firm are the best predictors of access to credit. The current exercises use the age of the firm instead of the value of the firm because endogeneity problems are more severe with firm's value than with firm's age. The performance of the firms was then specified to be a function of the age of the firm, whether it has financial statements, and other characteristics, such as type of ownership and the sex and age of the manager. As explained above, the effect of banking credit can be estimated by including the dummy variable *bancred*, and the estimates are consistent as long as the estimated Mill's ratio from the probability equation is included.

Under these assumptions, the model is identified. While the identification assumptions are in principle ad hoc, it is important to notice that similar results were obtained under a wide variety of alternative identification assumptions. Table 12 shows the results for all four measures of performance. The table shows that for the most part the characteristics of the firms do not affect the performance of the firms. The same applies for the sector dummies (not reported here). In the versions that included the total leverage of the firm, this variable had in general a significant positive effect on the performance of firms. In the versions in which the variable *uselott* was included in the performance equation, that variable was also a significant predictor of the reinvestment rate, but not of the other performance measures.

The results suggest that access to banking credit has a positive effect on performance. In all cases, the estimates on *bancred* have a positive sign and are large (though it should be kept in mind that employment is logged). Unfortunately, the results are not statistically significant. For

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[9] The previous version of the paper reported the results of the exercises including qualitative indicators such as willingness to exchange assets for debt (Exastdbt), whether the entrepeneur would use a lottery windfall to invest in the firm (uselott) and Exsupdbt (whether the entrepreneur would want to exchange suppliers/trade credit for banking credit) affecting the probability of receiving banking credit. Leverage was also excluded in the performance equation but not the probability equation, because it has so much predictive power in the probits that it would cause

instance, the point estimates indicate that just having access to bank credit would increase the (natural) log of employment by 2.28, almost 10 more employees in each firm. The implied size of the effects on total investment, profit rate and reinvestment rate are so large that they cannot be taken seriously. But they signal that, if statistically significant, the effects are large.

The t-statistics, however, are low. In general, the values are around one but not significant at any relevant significance level. The present data do not permit strong conclusions, but the results are highly suggestive.

In all cases, the correction for selection provides a negative estimate for the coefficient on λ. Once bancred is directly included on the performance equation, the fact that the firm is likely or unlikely to have access to bank credit does not enhance or diminish its performance. Indeed, the estimated effect goes in the opposite direction. In no case, however, are the results significant.

It turns out that the results reported in Table 12 are very robust to changes in the variables included in both regressions. This is not surprising, as the RHS variables are rarely significant. Experiments with eliminating some of the variables or including indicators of human capital of the owner, previous experience, or credit indicators at the time of the start-up of the business resulted in no substantial change: the sign for bancred and lambda remained positive and negative. While in very few cases the coefficients turned out to be significant from zero for some of the performance measures, those cases were easy to overturn by small changes in the set of regressors.[10]

To summarize, the results tentatively suggest that having access to credit constraints can have large effects on the size (employment), investment and profits of firms. However, even under the strong functional form assumptions inherent in the method, the data do not provide enough information to statistically reject the alternative hypothesis of no effect at all, at least at the significance levels traditionally used.

8.2   *Effect of Banking Credit II: Non-Parametric Bounds*

As stressed above, the previous methods hinge heavily on functional and distributional form assumptions. Those methods are parsimonious and commonly used, and there is no doubt that

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singularities in the performance equation. The qualitative results in terms of signs, magnitude and significance of the estimates on bancred and sample selection are the same as those discussed in the current version of the paper.

they are an essential exercise in investigating the effect of credit constraints. It is important to emphasize that in the present application the equations are not derived from any economic structural model; therefore, the estimates are simple reduced form effects, not directly interpretable parameters. As such, functional forms and distributional assumptions are not fundamentals of the problem, but rather additional assumptions imposed to solve it. This section explores a set of methods that completely dispense with functional and distributional form assumptions. Imposing less structure increases the robustness of the conclusions, but this comes at the price of necessarily reducing the sharpness of the possible conclusions.

This section adopts the general methods developed mostly by Manski (1995) and Manski and Horowitz (1995) to analyze the response to treatments. As before, access to banking credit is seen as a "treatment." It is also explicitly recognized that there is a selection bias problem, as the characteristics of firms endogenously determine whether they have access to credit from banks. Because these methods are not yet common tools, they are explained below in some detail.

Specifically, consider a population of J firms. Each firm $j \in J$ has observable characteristics x_j, and will have performance/behavior $y_j(t)$. That performance/behavior can occur in two mutually exclusive cases: the firm has no access to banking credit $t=0$ or, $t=1,$ the firm has access to banking credit. Firm j has a realized access to credit $z_j \in \{0,1\}$ and a realized outcome y_j. As before, the selection problem arises because the latent outcomes $y_j(t)$, $t \neq z_j$, are not observable, i.e., the econometrician does not observe the (counterfactual) performance that firms that received credit would have displayed if they did not have access as well as the performance that firms that did not receive credit would have displayed if they had enjoyed access.

From a random sample of the population of firms, a researcher can learn the empirical distribution P(x, z, y) of covariates, realized performance/behavior measures, and realized access to banks. The researcher's problem is to combine this empirical evidence with (identification) assumptions in order to learn about the distribution of response functions. Of particular interest is the average effect of access to banking credit,

$$E[y(1) \,|\, x] - E[y(0) \,|\, x]$$

Results are reported from the use of three different methods developed by Manski and Horowitz that are routinely used in this literature: Worst-Case Bounds, Exogenous Selection and

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[10] As with the data set, the LIMDEP codes used for these regressions are available from the authors upon request.

Instrumental Variables Bounds. The methods look to extract the most robust conclusions from the data, in the sense that they look for the worst and best case scenarios for the effects of the treatment (access to banking credit). Thus, if it can be established that access to banking credit has a positive effect in the worst-case scenario, then the data available will strongly indicate that it has a positive effect on firm performance.

All the methods are based on non-parametric estimation of probability functions. Thus, they are free of functional form assumptions.

8.2.1 Worst-Case Bounds

This procedure estimates the worst-case bounds. The outcome variable is assumed bounded, and normalized so that the lowest value is *y=0* and the highest is *y=1*. Let *y* a vector with the performance data; *z* the vector of binary variables indicating whether firms have access to credit. Also, let *x* be data on covariates, observable characteristics of firms.

This method computes for each treatment $t \in \{0,1\}$, the worst-case bounds on *E[y(1)|x]* and *E[y(0)|x]*:

$$E[y(1) \mid x, z = 1] \Pr ob(z = 1 \mid x) \leq E[y(1) \mid x] \leq E[y(1) \mid x, z = 1] \Pr ob(z = 1 \mid x) + \Pr ob(z = 0 \mid x)$$

and

$$E[y(0) \mid x, z = 0] \Pr ob(z = 0 \mid x) \leq E[y(0) \mid x,] \leq E[y(0) \mid x, z = 0] \Pr ob(z = 0 \mid x) + \Pr ob(z = 1 \mid x)$$

Combining these equations, the resulting upper and lower bounds on the average treatment *E[y(1)|x]-E[y(0)|x]* are

$$E[y(1) \mid x, z = 1] \Pr ob(z = 1 \mid x) - E[y(0) \mid x, z = 0] \Pr ob(z = 0 \mid x) + \Pr ob(z = 1 \mid x)$$
$$\leq E[y(1) \mid x] - E[y(0) \mid x] \leq$$
$$E[y(1) \mid x, z = 1] \Pr ob(z = 1 \mid x) + \Pr ob(z = 0 \mid x) - E[y(0) \mid x, z = 0] \Pr ob(z = 0 \mid x)$$

While the average or point estimate effect on the treatment cannot be estimated from the data, both lower and upper bounds can be estimated. Here, if the observable characteristics *x* contain a continuous variable, the method uses kernel estimation of *P(·|·)* and *E[·|·]*. In case all *x* are discrete, they are computed using cell averages.

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8.2.2 Estimates Assuming Exogenous Treatment Selection

A different set of bounds can be estimated if additional identification assumptions are imposed. One set of assumptions commonly used (implicitly or explicitly) is to assume that the selection of firms according to $z=1$ or $z=0$ is an exogenous process. In the present application, this assumption takes the form of the condition that the selection of firms in terms of their access to credit amounts to:

$$E[y(1)\,|\,x, z = 0] = E[y(1)\,|\,x, z = 1]$$
$$E[y(0)\,|\,x, z = 0] = E[y(0)\,|\,x, z = 1]$$

This assumption, which is non-testable, is equivalent to assuming that the sample comes from a randomized experiment. Under this assumption, the effect of having access to credit is

$$E[y(1)\,|\,x, z = 1] - E[y(0)\,|\,x, z = 0] = E[y\,|\,x, z = 1] - E[y\,|\,x, z = 0]$$

As before, if the observable characteristics x contain a continuous variable the method uses kernel estimation of $P(\cdot\,|\cdot)$ and $E[\cdot\,|\cdot]$. In case all x are discrete, they are computed using cell averages.

8.2.3 Instrumental Variable (IV) Bounds

Sharper bounds could be obtained if further identification assumptions are made. One possibility, which is widely used in other econometric exercises, is to assume that there is a set of (instrumental) variables that can be used to sharpen the estimation of the bounds. For the exercises in terms of non-parametric bounds, the procedure here was developed in Manski (1995) and Manski and Horowitz (1995).

Specifically, let v be instrumental variable (IV) data, and w the covariates not used as instruments. The IV bound on $E[y(1)|\,w]$ is

$$\sup_{\{v\}}\{E[y\,|\,w, V = v, z = 1]\Pr ob(z = 1\,|\,w, V = v)\}$$

$$\leq E[y(1)\,|\,w] \leq$$

$$\inf_{\{v\}}\{E[y\,|\,w, V = v, z = 1]\Pr ob(z = 1\,|\,w, V = v) + \Pr ob(z = 0\,|\,w, V = v)\}$$

The IV bound on *E[y(0)|w]* is defined analogously. The lower (upper) bound on the treatment effect is the lower (upper) bound on *E[y(1)|w]* minus the upper (lower) bound on *E[y(0)|w]*.

And, as before, if the observable characteristics *x* contain a continuous variable the method uses kernel estimation of *P(·|·)* and *E[·|·]*. In case all *x* are discrete, they are computed using cell averages.

8.2.4 *Results: Bounds on the Effects on Banking Credit*

In terms of firm behavior and performance, these methods will be applied to the performance/behavior measures used before: employment (Number of Employees), reinvestment rate, profit rate, and firm's value. Total investment was not considered, because assessing the effect of total investment makes it necessary to control for firm's size (assets or employment). The sample size, however, is not large enough to allow a reliable use of no parametric methods with the rich structure of covariation across independent variables.

The method makes it possible to investigate the effect of access to banking credit on different *classes* of firms. A first dimension to explore is the age of firms. Thus, an attempt is made to capture the effect of credit constraints on firms in different stages of their life cycle. A second dimension involves distinguishing among firms with different types of organization and management.

Unfortunately, the sample is not large enough to permit a reliable estimate of the joint distribution function of the firm age, type of management, and access to bank credit. The key problem is that the age of a firm is a continuous variable, and kernel estimators, to be reliable, need large numbers of firms for each different age. To circumvent this problem it was decided instead to classify firms in deciles of age, then estimate the probabilities for each *cell* of firms represented in each of the deciles. This avoids uninteresting large sensitivities in the observations of the characteristics of one or two firms in ranges where few firms are observed in the sample. Using quintiles instead of deciles did not significantly change the results.

Based on results obtained from Heckman's two-step estimators, *uselott* is utilized as an instrument for estimating IV bounds. In general, this instrument sharpens the bounds just slightly. It is certainly not enough to yield point estimation and moreover, it cannot rule out zero

or negative values as a possibility. Similar results were obtained using other variables as instruments.

Figures 3-6 show the results. The first panel of each figure shows the different values for the upper and lower bound. Those panels show the results according to firm type (age, TYPOWN=0,1), and according to whether worst/best case bounds are estimated or whether **uselott** is used to sharpen the bounds. In the latter case, the figures are labeled with the suffix "iv." The horizontal axis of the figures is the mean age of the deciles where the firms belong. The second panel of each figure shows the (point) estimate of the effect assuming that the sorting between firms with access and without access is exogenous. This estimate is shown for firms of all ten age groups and for the two types of management.

Figure 3. Bounds and Average Effects of Having Access to Banking Credit on Firm's Employment

Bounds on Reinvestment Rate

**Average Effect, Assuming Exogenous Selection**
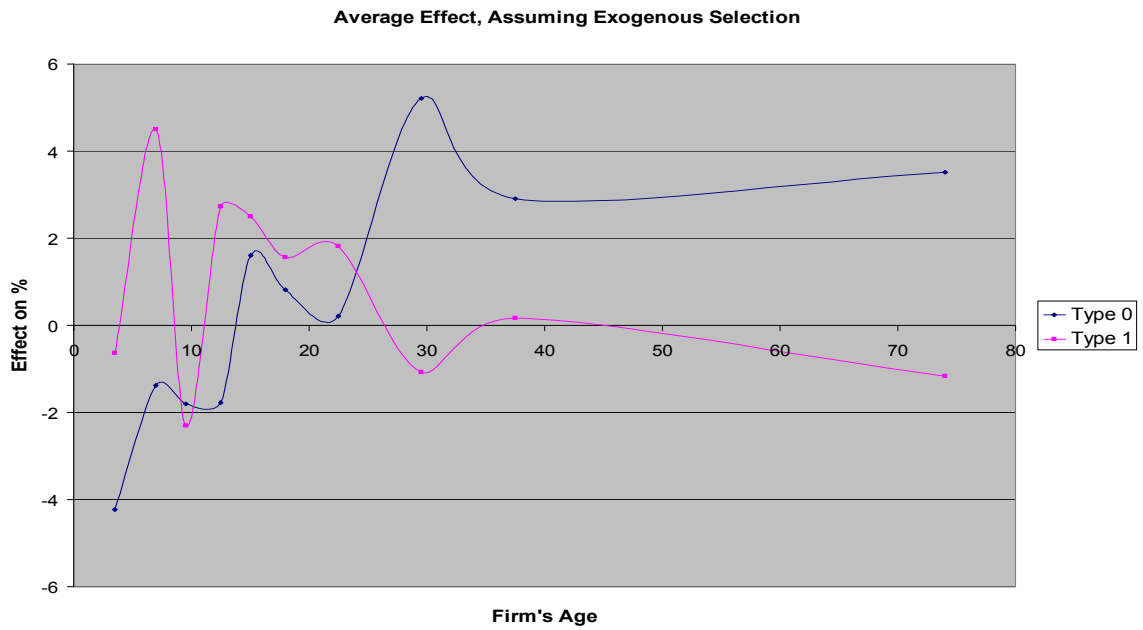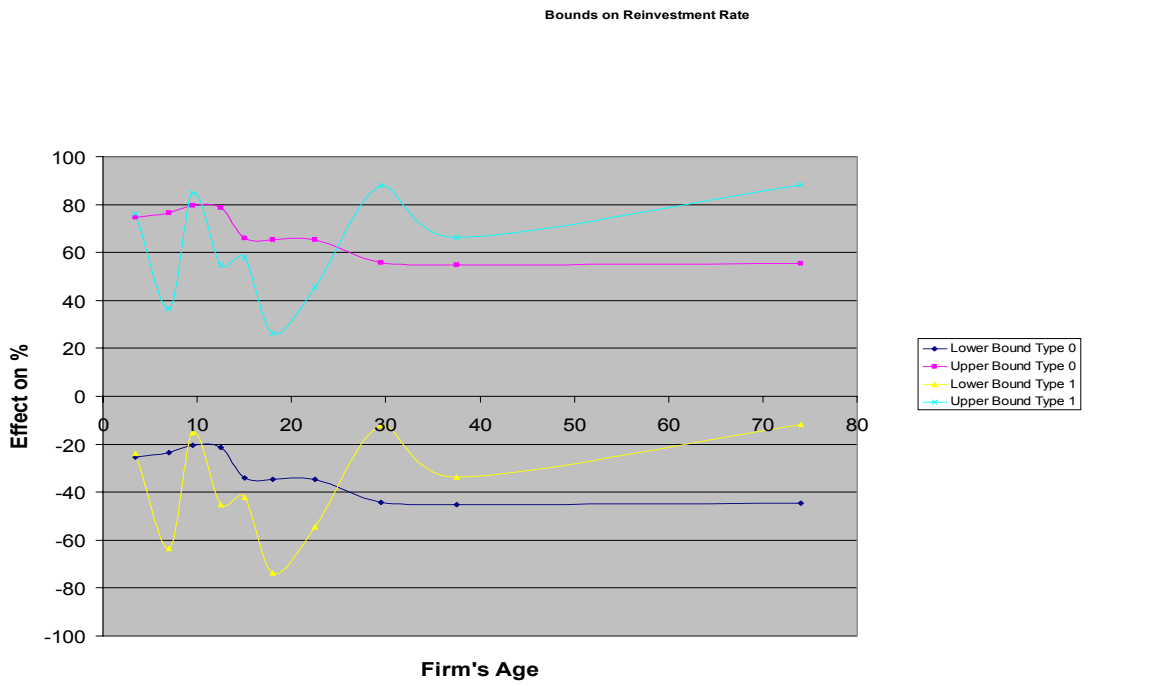
Figure 4. Bounds and Average Effects of Having Access to Banking Credit on Firm's Employment

Bounds on Firm's Employment

Average Effects, Assuming Exogenous Selection

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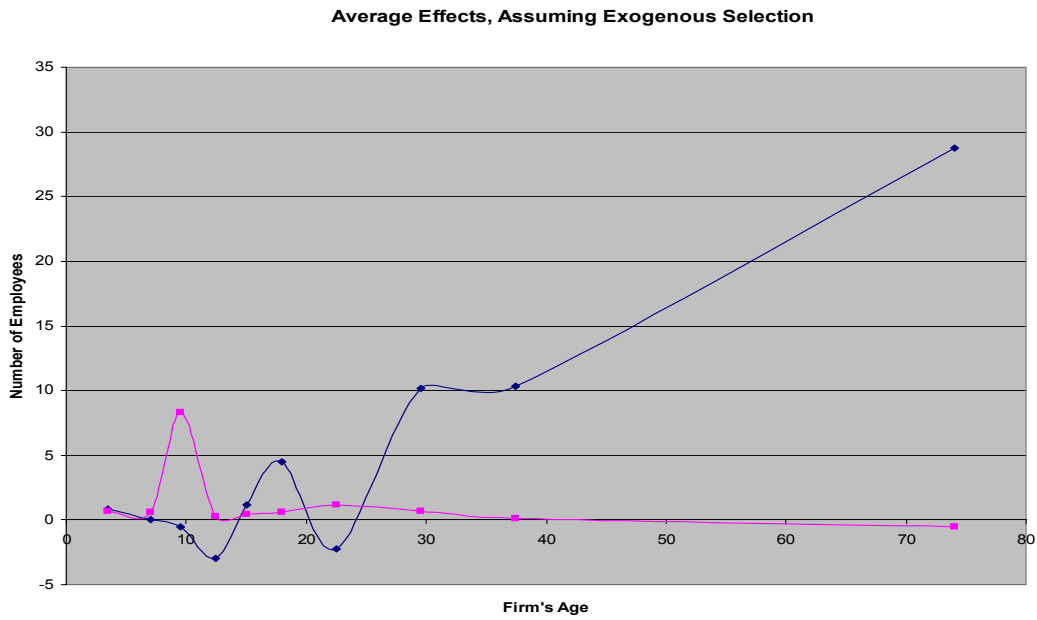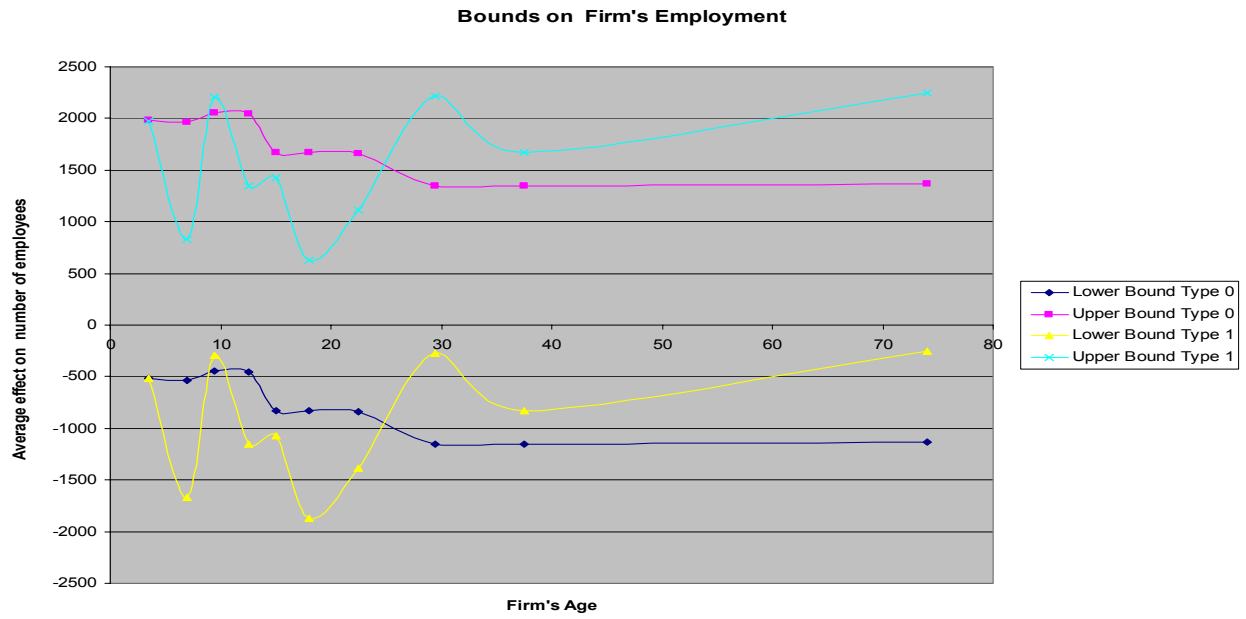
Figure 5. Bounds and Average Effects of Having Access to Banking Credit on Firm's Value

Bounds on Firm's Value

Average Effect, Assuming Exogenous Selection
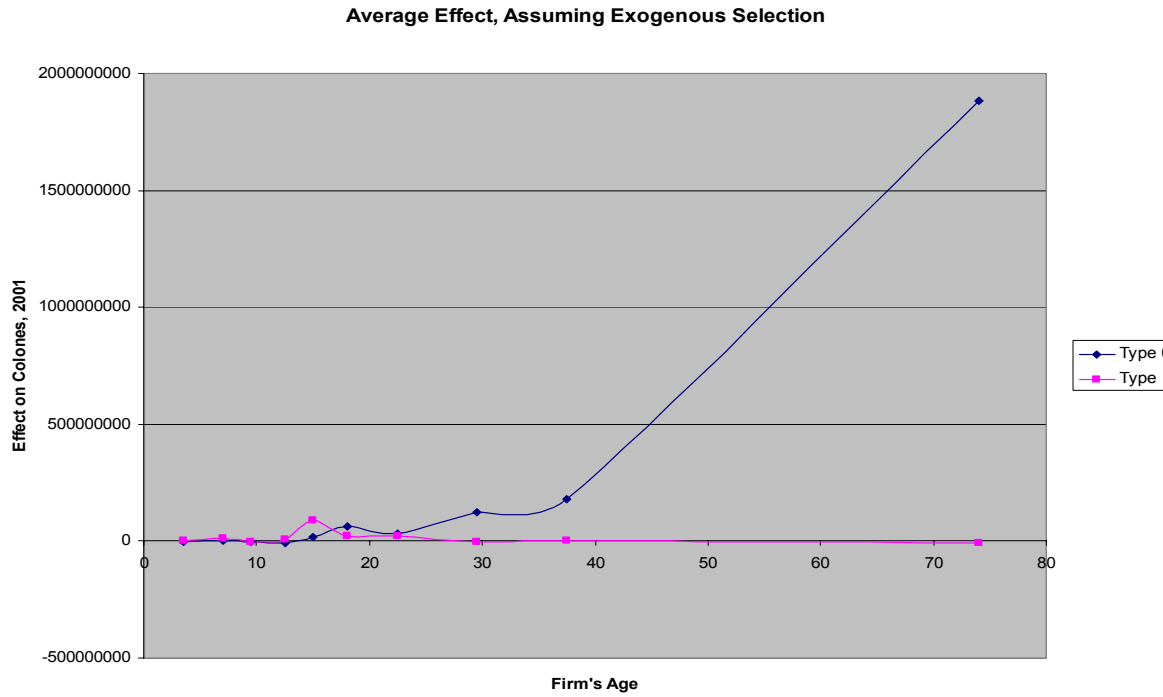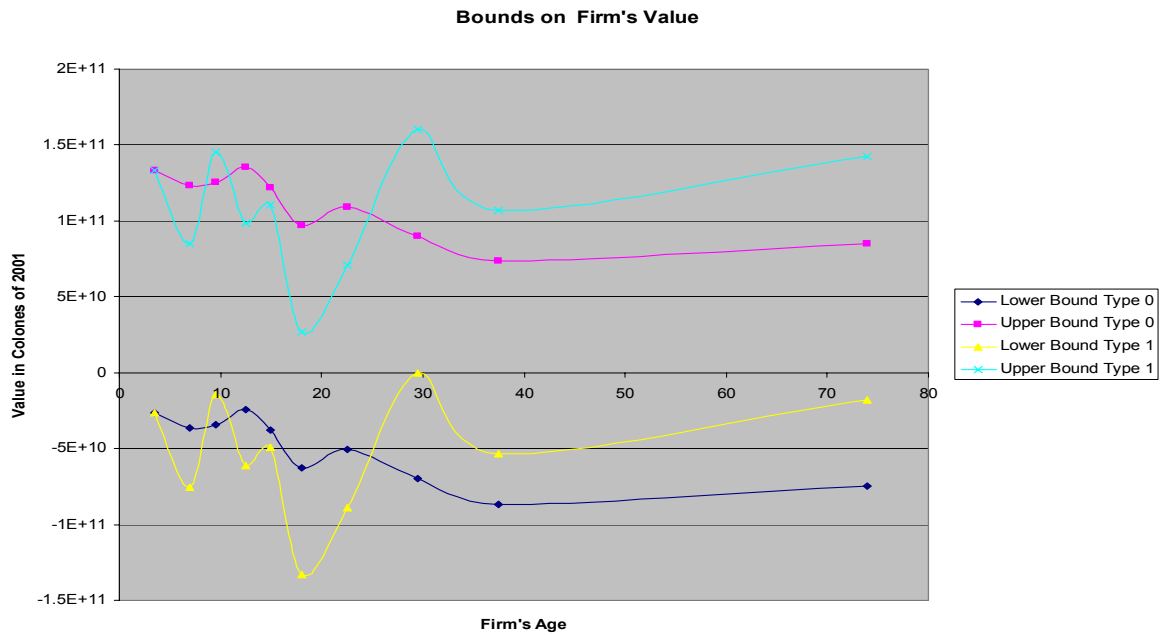
Figure 6. Bounds and Average Effects of Having Access to Banking Credit on Firms Profits
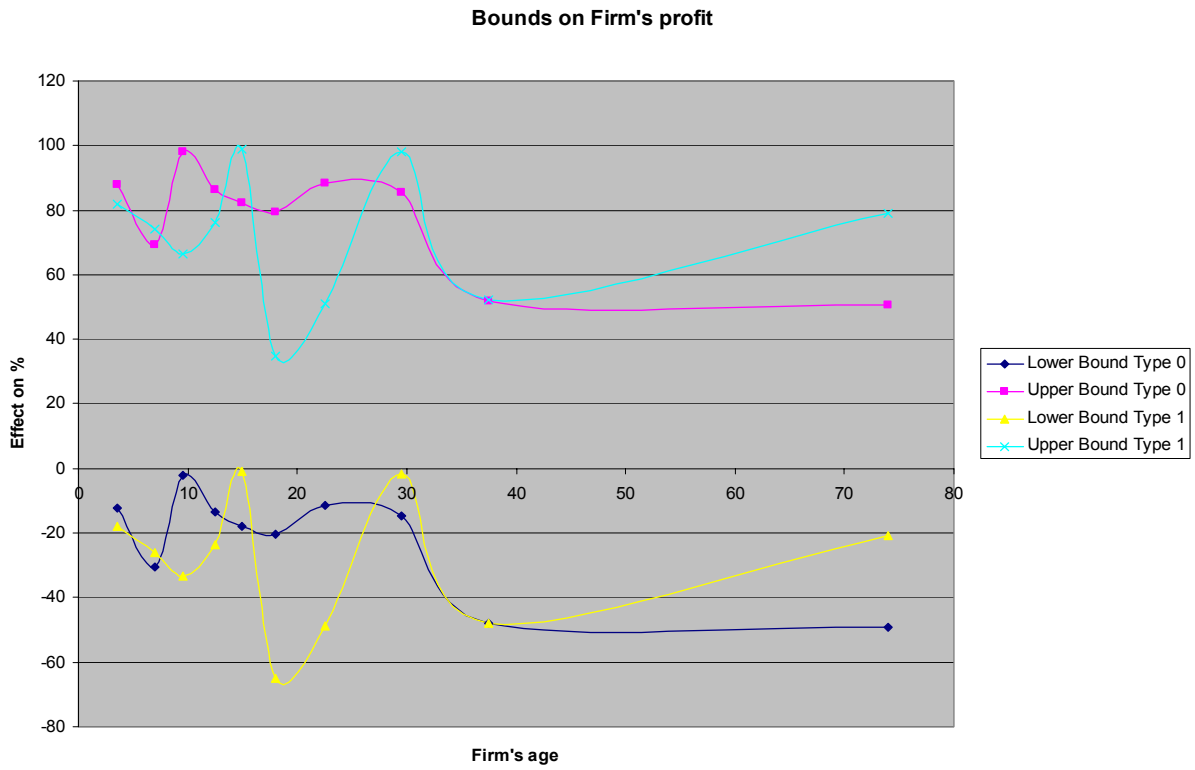
Bounds on Firm's profit

Average Effect, Assuming Exogenous Selection

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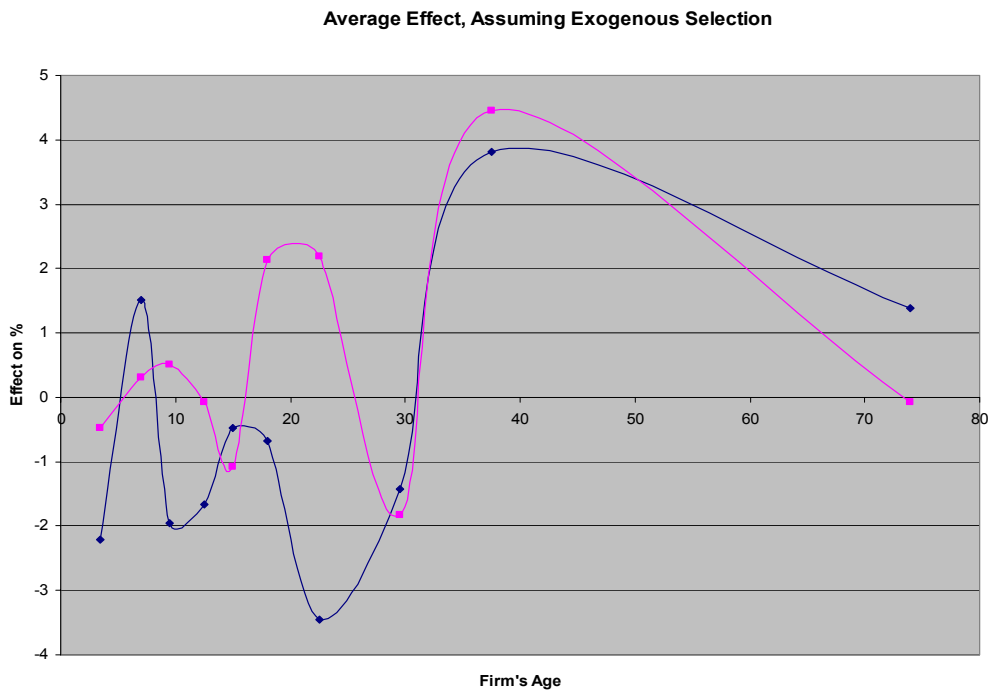
With worst and best case bounds, there is always the possibility that the effect of having access to banks is zero, as the interval defined by the bounds include zero in general. This is in general a problem with this methodology. When so little restrictions are imposed, most datasets fail to rule out the possibility that average performance under the two alternatives (here bank credit or no bank credit) may be the same. However, one advantage of these methods is that they explicitly describe the entire set of possibilities allowed by the data for the effects. In this sense, it is interesting that the worst-case bound is closer to zero for younger firms than for older firms. Therefore, this method suggests, without clearly implying, that banking credit is more likely to benefit younger firms than older ones.

Interestingly, using instruments such as *uselott* does not greatly sharpen the bounds, but it does suffice to move their range to exclude zero. Indeed, with the IV-bounds, zero is sometimes outside the admissible range for younger firms managed by their owner. These facts help to support the view that banking credit is more likely to have positive effects on the performance/behavior of firms at younger ages. A very important point is that, in general, the bounds allow the possibility of very large effects of banking credit on the performance/behavior of firms. While in the worst-case scenario it cannot be ruled out that the effect of having access to banking credit is negligible or even negative, the bounds indicate that the effects can potentially be huge.

These methods do not provide a direct way to obtain a point estimate. One possibility is to take the average between the worst and the best-case bounds, or between the upper and lower bounds of the IV estimator. But, such a selection criterion does not have an explicit, conceptually sound, basis. If one is willing to accept exogenous selection as an identification assumption, one could directly compute a point estimate for the effect of banking credit. Those estimates are reported in the lower panels for each of the performance/behavior measures. As can be seen, in general the point estimates are positive, and indeed, very large, for all age groups and management types. They appear larger for older firms.

However, one must be aware that, as measured firm age increases, the sample includes smaller fractions of firms with own-management and non-banking credit. This mere fact reduces the reliability of the estimated effects, not only for the point estimates with exogenous selection but also for worst/best-case bounds and IV-bounds. Moreover, the bounds seem more symmetrical for the last age-decile. Thus, the data is rather uninformative for that last age group.

With this limitation of the dataset in mind, it is necessary to emphasize that the results are more robust for younger firms.

9. Conclusions

This paper has examined the finances of firms in Costa Rica, investigated the variables that explain access to formal banking credit, and explored the effect of credit limitations on the behavior and performance of firms. Those objectives were served by directly collecting information on firms of different size in a variety of manufacture sectors in the Metropolitan Area in Costa Rica. Given the lack of good data sources in Costa Rica, the first contribution of this study is precisely the data that are collected. Applying a variety of econometric techniques to the data, however, has provided interesting results.

First of all, access to banking credit is very far from widespread. Indeed, consistent with older studies, Costa Rican firms still depend to a large extent on informal credit and trade credit to finance their operations. Moreover, this dependence is only a matter of intensity, as many firms do not obtain banking credit at all. There is also strong evidence that smaller and younger firms have significantly less banking credit than older, larger firms. The small importance of banking credit is most vividly observed for entering firms; the data show that a large share of those firms' funds come from own savings, transfers from relative transfers and informal credit.

Also explored were the factors that determine access to banking credit. The use of simple econometric methods demonstrated that the probability of having banking credit and the fraction of banking credit with respect to total debt are mostly affected by firm's characteristics, not entrepreneur's characteristics. The main determinants seem to be the firm's value, the firm's size in terms of number of employees, the firm's age, and whether it keeps formal accounting procedures. A serious limitation of this part of the study is that those firms' characteristics are the outcome of previous, current and future behavior and performance, which, in principle, are affected by the accessibility to credit itself, and the longitudinal data needed for identifying the direct effect of those factors are not available. Consequently, research centers in Costa Rica should recognize the importance of setting up a longitudinal survey on the production and financing decisions of small and large firms.

It was originally expected that personal characteristics such as the education and age of the entrepreneur would be key factors behind access to credit. Surprisingly, though, the data

generally do not single out characteristics of the entrepreneur that would explain access to credit for ongoing firms or new firms. Interestingly, previous experience as entrepreneur has a negative and significant effect on the participation of banks in the financing of new firms. This finding is compatible with several very different hypotheses, all of them highlighting the importance of credit constraints for new firms. A similar result, but without statistical significance, holds for entrepreneurs with other sources. Again, it would be very useful to have available longitudinal data in order to discern between these alternative hypotheses.

Finally, adopting ideas from the econometric literature on treatment effects, results from two methods to correct for selection biases were reported: a parametric two-step point method and a non-parametric method that estimates upper and lower bounds for the effect of having access to bank credit. The two methods are very different, and both failed to render sharp or statistically conclusive results. But, both methods pointed in the direction that having access to banking credit can have large effects on the behavior of firms, increasing their size, investment, and profits. Once again, though, it appears that the results could have been much more conclusive had better data been available.

Appendix: Additional Tables

Table 13. Screening Actions: % Frequently to Always

Item	Total sample	Demog. Type		Inst. Type			
		Met.	Rural	Pub.	Priv.	Co-op	Other
# of Intermediaries	(31)	(13)	(18)	(15)	(8)	(5)	(3)
Visit the firm	64.5	84.6	50.0	60.0	75.0	60.0	66.6
Study the project evaluation	87.0	92.3	83.3	93.3	87.5	60.0	100.0
Study financial statements	93.5	100.0	88.8	93.3	100.0	66.6	100.0
Analyze risk of project	87.0	76.9	94.4	93.3	75.0	66.6	100.0
Analyze sectoral risk	61.2	61.5	61.1	60.0	62.5	60.0	66.6
Analyze international risk	19.3	30.7	11.1	13.3	37.5	20.0	0.0
Assess liquidity of collateral	93.5	92.3	94.4	93.3	100.0	66.6	100.0
Market value of collateral	96.7	100.0	94.4	100.0	100.0	66.6	100.0
Check reputation of applicant	90.3	100.0	83.3	93.3	100	60.0	100.0
Physically audit collateral	80.6	92.3	72.2	66.6	100.0	100.0	66.6
Suggest modifications to project	54.8	61.5	50.0	60.0	50.0	60.0	33.3

Table 14. Criteria for Granting Loans: % Important to Crucial

Item	Total Sample	Demog. Type		Inst. Type			
		Met.	Rural	Pub.	Priv.	Co-op	Other
# of Intermediaries	(31)	(13)	(18)	(15)	(8)	(5)	(3)
Solvency of applicant	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Existence of project evaluation	90.3	84.6	94.4	100.0	75.0	66.6	100.0
Profitability of project	96.7	92.3	100.0	100.0	87.5	100.0	100.0
Credit references	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Existence of collateral	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Type of collateral	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Value of collateral	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Liquidity of collateral	96.7	92.3	100.0	100.0	87.5	100.0	100.0
Previous experience with borrower	96.7	100.0	94.4	100.0	87.5	100.0	100.0
Information from visit	96.7	92.3	100.0	100.0	87.5	100.0	100.0
Risk of project	93.5	84.6	100.0	93.3	87.5	100.0	100.0
Economic sector of project	87.0	84.6	88.8	100.0	87.5	60.0	66.6

The answers come from the credit manager of each intermediary and other credit and collection personnel. The sample contains answers from fifteen agencies of the three public banks, eight private banks, five savings and credit cooperatives and three "other" banks. The intermediaries were divided according to two classifications: Demographic types (Metropolitan or Rural) and Institutional types (Public, Private, Co-operative, and Other). These tables as well

as many others are discussed in Monge, Cascante and Hall (2001). Here, the importance of an item is summarized by grouping the answers in *Frequently to Always*, *Important to Crucial* and *Yes*.

Table 15. Use of Credit Bureaus by Intermediaries

Private\Public	Yes	No	Total
Yes	8 (4)	3 (3)	11 (7)
No	10 (5)	10 (1)	20 (6)
Total	18 (9)	13 (4)	31 (13)

Table 16. The Functioning of Four Credit Bureaus

Item	Managed by Coalitions		Independent Firms	
	SUGEF	**ABC**	**Bureau A**	**Bureau B**
Operation of Bureau	2 years	1 year	41 years	5 years
Number of clients	103 intermediaries	8 banks	Not revealed	1219
Individuals in database	424,342	Unknown	700,000 apx.	600,000 apx.
Employees	4	2	60	15
Process. of Info	Banks	Banks	Employees	Clients/Employees
Credit Histories	Good and Bad	Bad	Good and Bad	Bad
Grading of debtors	Yes	No	Yes	No
Other Information	No	Not yet	Yes	Yes
Consultations per day	200 appx.	Not revealed	Not revealed	7,500 apx.
Transfer of Information	Messengers	Modem	Phone-Modem	Modem-Fax
Time per consult.	24 hrs.	Instant	Old Info: Instant Updated: 24 hrs	Instant
Memory of Data	Infinite	10 years	Infinite	3000 days
Other services	No	No	Yes	Yes
Charges	Free	Lump per month	Per consult	Per consult
International Services	No	No	Yes	No

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