The Pennsylvania State University

The Graduate School

College of Agricultural Sciences

ESSAYS ON ENTREPRENEURSHIP AND CREDIT IN COLOMBIA

A Dissertation in

Agricultural Economics, Sociology, and Education and, Operations Research

by

Monica Roa

Submitted in Partial Fulfillment
of the Requirements
for the Degree of

Doctor of Philosophy

August 2016

The dissertation of Monica Roa was reviewed and approved* by the following:

Spiro Stefanou
Professor Emeritus of Agricultural Economics
Dissertation Advisor
Chair of Committee

Hoyt Bleakley
Special Member
Associate Professor of Economics
University of Michigan

Edward Jaenicke
Professor of Agricultural Economics
Pennsylvania State University

Scott J. Colby
Assistant Professor of Agribusiness Management
Pennsylvania State University

James R. Tybout
Professor of Economics
Pennsylvania State University

Daniel Azzara
Professor of Agribusiness
Department Head of Agricultural Economics, Sociology, and Education

*Signatures are on file in the Graduate School.

Abstract

Financial development is one of the engines for economic growth. Developing economies face two challenges regarding financial development: financial inclusion and access to credit. While financial inclusion focuses on the use, access to credit focuses on the prohibitive costs or barriers to use credit, such barriers include onerous paperwork, travel distance and legal hurdles, among others. In this dissertation, we analyze the impact of use of credit on exporters and the impact of physical distance on credit flows and its impact on firms' performance.

In the first essay, we use Colombian manufacturing data on exports and external financing for the period 1998 − 2006 to estimate the credit elasticity of exports. We use bank-firm linked data to construct a supply side instrument for a manufacturer's demand of credit, which we use to address the reverse causality between a manufacturer's export revenue and its demand for credit. We find that access to credit produces a significant increase on a manufacturer's export revenue explained by the positive effect of credit on an exporter's market reach - number of destinations. Across manufacturers the effect of credit on a manufacturer's export revenue varies by size. While medium-sized manufacturers use credit to increase their market reach, market penetration and product mix, large manufacturers only use credit to increase their market reach. When evaluating the impact of finance considering demand drivers as destination country or product characteristics, we find that external financing has greatest impact on the smallest firms.

In the second essay, we use a detailed dataset of Colombian firms and bank branches to study how information and transport costs affect firms' credit access. We also use credit flows in a cluster analysis combined with a market segmentation model to shape geographical markets, and find that high transactional and information costs tightens lending at the intensive and extensive margin in competitive markets. At firm level, we find that this relationship is stronger for smaller firms and reflects lower debt. Monitoring costs are especially high for medium-sized firms and this is reflected in a poor performance

of the loan, nevertheless this effect diminishes in competitive markets. These results suggest that distance plays a stronger role for accessing to credit when soft information is more valuable.

In this dissertation, we study two different aspects of financial inclusion and access to credit and find evidence of differentiated impact at firm level. We confirm external financing is important to export decision but its effect persists over time for small- and medium- sized firms. Regarding access to credit, we find geographical distance is barrier to integrate markets. The limitation extends, especially, to small firms in two senses: 1) tightening credit and 2) poor loan performance.

We contribute to a nascent literature that exploits contract-level information. Future research analyzing credit registries, or changes in the coverage of existing registries, to identify the impact of information on financial inclusion, access to credit and market efficiency is needed.

Table of Contents

List of Figures

List of Tables

Acknowledgments

This is the end of a journey that began with a lunch with Danielken Molina in Bogota when he told me about Penn State. God put along the way several number of people I want to express my gratitude.

Many would feel blessed if they engage themselves with one advisor. I had the pleasure to learn from, work with, and intellectually spar with two advisors. First, I want to thank my advisor Spiro Stefanou. I am in debt for his guidance, patience and encouragement throughout the research experience at Penn State and Wageningen. Second, I want to thank my co-advisor, Hoyt Bleakley, who I have had the pleasure to work with since 2005. His continuous challenges inspired me to follow the research life. I wish to thank my coauthor, Danielken Molina who helped me to build the bridge between trade and finance. All three gave me the best gift a graduate student can have: enormous amount of their time.

I would like to express my gratitude to the members of my committee: Ted Jaenicke, James Tybout and Scott Colby. I look up to their accomplishments in so many ways. Receiving their comments on this dissertation, together with their approval, has been an enormous joy. Special thanks to Ted Jaenicke who not only gave me the welcoming words to the program in 2010 but also a permanent helpful through the program. I also want to thank Jeya Chandra who gave me all the support to pursue and finish the Operations Research title and, Alfons Oude Lansink with whom I had nothing but a rewarding experience working at Wageningen.

I am grateful with my colleagues and friends at Penn State and Department Nacional de Planeacion: Esha Zaveri, Gabriel Piraquive, Nancy Daza and Nestor Gonzalez. This dissertation would have never happened without their financial and intellectual support. Special thanks to Maria Fernanda Lovo and Diego Gomez who helped me understand the insights of the financial system in Colombia.

I would have not achieved any goal of this journey without my family: Cristina Rodriguez and Juan Roa. Together they gave me all their love and support, and instilled in me a deep understanding of the meaning of a coherent academic. They were always ready to give the best of advice.

I would like to thank a special someone. Meeting Mehmet had a relaxing effect in the most stressful times. It seems that hard work is followed by the loveliest rewards.

Last but not least, I would like to thank all my amazing friends. To the girls who I found a family with: Monica Castellanos, Bitia Salas, Vera Van de Koevering, Judit Jacobs, Nina Behr and Tijana Jovanovic. To my friends in Colombia who despite the distance and time, always supported me: Claudia Carvajal, Maria Fernanda Cortes and Lucas Rodriguez. To my friends in Wageningen and the United States who made the ride easier: Elsa Quicazan, Prashanna Balaji (Bala), Victor Lascano, Luis Carter, Milagro Saborio, Jose Luis Preciado and Angelica Sanchez. To the gangs who made me smile with the different adventures we shared: the Turkish, the Italian and the climbing gangs.

Chapter 1

Introduction

Local financial development and the increase in the outreach of the provision of financial services are two relevant engines of growth and poverty reduction in Latin America and worldwide (Burgess and Pande, 2005; Beck, Demirgüç-Kunt and Levine, 2007; Levine, 2008; Demirguc-Kunt, Beck and Honohan, 2008; Arestis and Caner, 2009; Bittencourt, 2010). Firms report that access to finance as the major obstacle for the growth of their business (WBES). Several studies have established that financial development promotes the expansion of industries relying heavily on external finance, intangible assets and R&D in export markets (Beck, 2003; Hur, Raj, and Riyanto, 2006; Manova, 2008, 2013; Svaleryd and Vlachos, 2005). Financial development, especially in developing economies, has been pursued through commercialization of bank services and through an intense process of liberalization and globalization of banking (Hanson, 2003; Cull and Martinez Peria, 2010). The limited access to external funds can constitute an obstacle for firms wishing to start, maintain or expand their activities. Firms have two basic sources to finance their activities: internally from retaining earnings and externally from borrowing from banks and other financial institutions. The difficulty or ease the way the firm has access to fund their activities will affect its actions (e.g. if the firm does not have enough resources and access to external capital is difficult, it would have to reduce the scale of production).

Large, upfront costs are incurred when firms seek to expand beyond the national borders. Some these are relate with the large fixed costs to enter in an export market (Roberts and Tybout 1997; Bernard and Wagner, 2001; Bernard and Jensen 2004). These costs include identifying potential markets, developing distribution networks and, adapting products to match foreign regulations and tastes. Exporters also face other costs related to an increase in manufacturer's marginal cost. These costs are

explained by the rise of per unit charges due to additional transport fees when shipping cargo to a foreign destination, or by the per unit costs increase as manufacturers decide to upgrade a product's characteristics to match consumer preferences in more demanding foreign markets, or because a manufacturer engages in per unit marketing costs following a sales strategy to position its product in the foreign market. The above mentioned costs are difficult to observe and the revenue may be realized after long periods. Then, the requirements of outside investors are difficult to meet making exporting activities difficult to fund (Myers and Majluf, 1984; Harris and Raviv, 1990). Due to the large costs exporters face, they are considered heavily dependent on external finance resources. A firm wanting to export has to cover additional fixed exporting costs before realizing any sales revenue. In this framework, borrowing needs emerge as a natural outcome.

However, enterprises are not always able to have access to bank services. Many lack access to financial services as these services have prohibitive costs or there are barriers to their use, such as regulations requiring onerous paperwork, physical distance, legal hurdles, or other market failures (Demirguc-Kunt, Klapper, Singer and Van Oudheusden, 2015). Some of the problems affecting traditional banking activities, are the cost of monitoring and the ex-post moral hazard which are fueled by asymmetric information between the lender and the borrower. Thus, transaction and agency costs, which can be proxied by the physical distance between the bank and the borrower, remain a significant feature to explain the access and success of a loan. Moreover, if information on creditworthiness must be collected at local level because soft information[1] is not available, small firms are in disadvantage. Hence, repeated lender-borrower interactions will be necessary to collect sufficient soft information on clients to overcome informational asymmetries, making distance a more binding constraint at the beginning of the credit relationship.

[1] Soft information cannot be verifiably documented in a report that the loan officer can distribute. Hard information is quantitative, easy to store and transmit but costly to produce. (Petersen 2004; Berger et al., 2005)

In recent years the financial literature has seen a growing interest in the importance of physical distance in access to banking services as a proxy of transportation costs and informational asymmetries between lenders and borrowers (Alessandrini, Fratianni and Zazzaro, 2009). The advantage of using physical proximity is that reflects the spatial diffusion of bank branches, which reduces the distance between the institution and local costumers. Since proximity entails a competitive advantage in terms of less costly searching and monitoring, banks can spatially discriminate their price setting (Calem and Nakamura, 1998; Degryse and Ongena, 2005) and then create local concentration. At the same time, in several credit markets, both in developing and developed countries, the intense process of consolidation and the internationalization of the banking industry increased the functional distance between banking decision centers and local economies, increasing the agency costs, with adverse consequences on firms' access to credit, especially for more informationally opaque SMEs (Mian, 2006; Alessandrini, Presbitero and Zazzaro, 2009, 2010). Geographical distance increases the cost of gathering information and, can be a proxy for other transaction costs. A long distance could increase transportation cost to a point of making the visit to the bank a binding constraint for the entrepreneurial activity.

The context for this study is the Colombian financial sector. Colombia is a developing economy that faces challenges with regard to financial system and makes an ideal environment to frame the above-mentioned topics. The following are the challenges of the financial system. First, despite the advances in regulation and supervision, there is a need for promoting greater transparency through legislation and information systems. The second group of challenges concerns with multiple market failures in matching supply and demand for financing some market segments. In Colombia, these failures are particularly severe in the agriculture sector (due to the risks associated with climate, marketing, and prices; the concentration of risk based on activity or region; limitations in collateral; high transaction costs involved in providing small-scale loans across broad geographic areas) and in the infrastructure sector (due to the strong presence of externalities and macroeconomic, political, and other risks). And, third, increasing financial inclusion, in order to alleviate liquidity constraints on households and firms.

This dissertation proposes two frameworks to analyze the above aspects by constructing a detailed information on exports, location, financial statements and bank-firm data for Colombian firms. We also constructed an unbalanced panel data set with the location, financial statements and income variables of banks and, deposits and loans by city-bank from 1998 to 2006. While data offers rich information, there are caveats to bear in mind. First, since the selection of the sample is not random, we cannot claim that results are representative of the all industrial sectors of economy. Second, because firm coverage varies by country, one has to check that the results are not driven by variations in the destination country. Third, since bank data is not geocoded, one have to assess different ways to calculate the distance to between lender and borrowers. Finally, as firms report the city were they are registered, we can assume that location do not change on time.

The implications of credit by examining its role in continuously successful exporters is the focus of Chapter 3. The model evaluates the impact of credit on the extensive and intensive margin of trade at firm size. The recent literature on international trade and finance (Muûls, 2008; Chaney,2013; Feenstraetal.,2013; and Manova,2013) finds that credit constraints have a negative significant effect on both margins. We focus our attention on the differentiated effect of credit on intensive margin by firm. The contribution to the literature of trade and finance is on the modelling strategy of the use of credit. The contribution on this literature tends to center the attention on the impact of credit constraints and those are usually set exogenously for the country. In our model, banking exporters credit is endogeneized on capital abundance of the financial system.

Our results complement Muûls (2008) and Besedes et al. (2012) by offering an attempt for a full story of exports. Muûls (2008) and Besedes et al. (2012) show that credit constraints affect the extensive margin and the ability of the firm to export, but once a firm starts to export, credit constraints have no effect on the intensive margin. Our results suggests that this finding is only true for large firms. The result may be explained by recent literature on the role of risk in international trade (Rauch and Watson, 2003; Besedeš, 2008; Segura–Cayuela and Vilarrubia, 2008; Nguyen,2012; and Albornoz et al.,2012).

If financial constraints are endogenous to uncertain success or as Albornoz et al. (2012) refers to as low experience exporters, we can predict that firms with high initial uncertainty have a greater export product level. More interestingly, we find credit is not lineal on firm size.

The model also offers an attempt to understand frictions between credit and international trade in terms of the composition of external trade. We expect finance to be particularly important where up-front costs are higher.

If distance is a proxy of transport and information costs and contributes to spatial discrimination, then geographical credit markets deserve more attention. In Chapter 4, we present a framework to identify geographic credit markets in Colombia. Relations between borrowers and lenders represent a network and interaction is a crucial force that pulls firms and banks into clusters. Therefore, the local presence of markets is constantly evolving. As a consequence, clusters change their location, size and performance over time and cannot be framed into an administrative definition.

Based on the idea that credit market represents a network I also characterize the flows between cities and find that more experienced cities associated among themselves, which suggest barriers to reach remote areas. Barriers to financial outreach in remote areas generally include poor infrastructure, bad geography, fuzzy legal framework and low population density (Gulli and Berger, 1999; Group, 2006). Hence, reaching poor customers in the more marginalized areas of the country is not financially sustainable, in general. The geographical distance separating the borrower from the bank is generally negatively correlated with the likelihood of repayment (Oke, Adeyemo and Agbonlahor, 2007) and, positively with interest rates, more intensive screening and more restrictive loan conditions (Pedrosa and Do, 2008).

Distance represents a cost for informational and transportation costs. The analysis of the credit market through a network setup allows me to disentangle both effects. If distance is a proxy of the information asymmetries, it should be uninformative in explaining the success of the loan as long as the size of the market increases, since the establishment of a credit relationship reduces information

asymmetries (Diamond, 1991; Behr, Entzian and Guttler, 2011). In contrast, if distance captures transportation costs, its effect would be the same regardless the number of direct or indirect partners. I find that distance is a proxy for both, transport and information costs for small firms.

This dissertation is organized as follows. Chapter 2 presents a brief description of the trade and financial system behavior in Colombia between 1998 and 2006. This is followed by Chapter 3 which presents a model to assess the impact of credit on exporters' performance. Next is Chapter 4 which presents the model to analyze the role of information measure through a definition of a geographical market. Chapter 5 presents a summary and conclusions along with suggestions for future research.

Chapter 2

Review of Colombian Banking, Trade Performance and Regional Differences

The National Administrative Department of Statistics (DANE, 2014) identifies Colombia's most important economic sectors are the financial sector (19.7% of GDP); commerce, hotels, and restaurants (12% of GDP); industry and manufacturing (11.2% of GDP); and transportation and communications (7.3% of GDP). Colombia has significant gaps in productivity compared with middle- and high-income countries. Between 1990 and 2011, there was near-zero growth in productivity in the economy, while countries such as Chile and Peru experienced growth of 20% and 4%, respectively (Ministry of Industry, Trade, and Tourism, 2011).

In the economic structure Small- and Medium- sized enterprises (SMEs) represent 95% of enterprises, 80% of private employment, and 35% of GDP. Despite the growth of SMEs over the last 20 years, the country's economy has not undergone positive structural change, in terms of moving toward more productive, value-added sectors (World Bank, 2015).

2.1 International Trade Characteristics

Colombia initiated efforts to internationalize its economy in the late 1980s but the real transformation occurred in 1990. Structural changes in the first half of the 1990s included a new Constitution, trade reform, exchange reform, foreign investment reform, financial reform and a labor reform (Ulloa and Constrain, 2013). As a result, international trade as a share of GDP has increased steadily, rising from 21% in the early 1970s to 32% in 2012. Between 1980 and 2012, goods exports increased from 7.6% to almost 16% of GDP, while goods imports rose from 13.5% to 16% of GDP. Despite the increase, Colombia is still among one of the more closed economies of the region. Colombia is the second most closed economy after Brazil (21% of GDP) (World Bank, 2015).

Despite the number of free trade agreements, Colombia possess relatively high tariff and non-tariff barriers, which limit access to and competition from external markets. Barriers to internal competition include limited access to finance, information gaps that prevent innovation and a regulatory framework.

According to the World Bank (2015), nearly 80% of the products for which Colombia has a comparative advantage are in the primary sector and have relatively low economic complexity (since their production requires low levels of technological capacity and human capital) and therefore make a limited contribution to economic growth. Between 1998 and 2006, 62.0% of Colombian exports depend on the products where the country does not have remarkable participation: petroleum 42.0%, coal 14.0%, coffee 5.0% and nickel 1.0%. Its main trade partners of Colombia are United States, European Union, Venezuela and Ecuador. The last two countries are petroleum exporters and net buyers of Colombian manufacturing.

Colombia achieved greater integration into the world economy, in part, thanks to several new trade agreements, the fall of the average tariff and the number of applied tariffs and an increase in the number of duty free tariff lines (Ulloa and Constrain, 2013). The Government established a single window for all trade requirements, complemented with a risk analysis system, which significantly reduced the number of inspections. Nevertheless, some trade barriers such as import registrations and licensing requirements persist (WTO, 2012).

For decades Colombia's economic development was based on the geographic center of the country. Recently, the dynamic has changed towards the northern region. Trade agreements and infrastructure roads have motivated to national and foreign firms to move to the north of the country.

Economic resources arriving to the three most important cities of the coast (Cartagena, Barranquilla and Santa Marta) are creating a new dynamic involving investments over USD10 billion, construction of new factories and the expansion of the old ones. This behavior is driven by region's proximity to Central America and United States, which is the most important firms' destinations and

markets with trade agreements with more than 70% of international trade going to this area. Cartagena, Barranquilla and Santa Marta have the best port areas with 42 private and public licenses. The fifth most important port of Latin America is located in in Cartagena. Thanks to their location, Barranquilla and Santa Marta have experienced dramatic expansion, since being located close to the exit and entry of goods implies lower costs for the firms. Additionally, these cities are located close to Magdalena River, which facilitates the transport of goods from the center of the country to the Atlantic Coast, and along with the economic attraction of Cartagena, Barranquilla and Santa Marta is the is *The Sun Route* (La Ruta del Sol), which connects the center and the north of the country (Ministerio de Transporte, 2014).

Colombia has a generally open trade regime with steadily falling tariff rates. However, non-tariff barriers, policy reforms and investments are pending in a number of significant areas and sectors (Ulloa and Constrain, 2013). According to the *Global Competitiveness Report 2011-2012*, Colombia's major obstacles for doing business are corruption, the supply of infrastructure, government bureaucracy and access to financing. Based on these problematic factors Colombia ranked 68 out of 138 countries worldwide, behind other countries of the region as Chile (rank: 31),Panama (rank: 49), Brazil (rank: 53), Mexico (rank: 58), Costa Rica (rank: 61), Uruguay (rank: 63), and Peru (rank: 67)

2.2 Financial System Characteristics

The financial system plays a fundamental role in economic growth (Beck, Levine and Loayza, 2000). An efficient financial system makes it possible to: 1) channel resources to more productive projects; 2) redirect short-term savings toward long-term investments and allocating resources to productive investments; 3) smooth consumption across time, reducing liquidity constraints and lessening the negative effects of shocks on well-being; and 4) reduce the impact of volatility and macroeconomic shocks (IADB, 2014)

Colombia has a broad financial system, dominated by complex financial conglomerates from which, credit institutions (mostly banks) account for about half of the financial system assets (IMF, 2013). Colombia's financial sector is highly concentrated, especially in the banking sector. According to "Superintendencia Financiera de Colombia" (SFC) three financial groups account for close to 66% of total assets as 2014. International assessments indicate that this situation is a source of systemic risk and emphasize the need to strengthen financial regulation and supervision in this area (IMF, 2014)

The flow of financing is dominated by commercial banks, which account for 44% of all financial system assets (62% of GDP). Loans to the private sector (50% of GDP) are low compared with other countries in the region, such as Brazil (71% of GDP) and Chile (106% of GDP), and compared with high-income countries (150% of GDP) (World Bank, 2015) The cost of credit (11%) is higher than in other countries in the region, such as Chile (9.3%) and Mexico (4.2%), and higher than in high-income countries (2.6%). Access to credit for small firms is limited. In 2013, barely 41% of SMEs obtained loans, with credit to this segment constituting barely 7% of total credit to the private sector. These factors are matter of interest considering the role of financing in increasing an economy's productivity, and the dominant role of SMEs in Colombia's economy.

Financial regulation and supervision its financial system remains relatively undeveloped compared with other countries in the region. In 2012, the World Economic Forum's Financial Development Index ranked Colombia 46th, behind Chile (29th), Brazil (32nd), and Peru (41st).

Financial policies, especially those related with supervision and regulation, were triggered by the crisis at the end of the 1990's and the mini-crisis with the Government bonds at 2002. The country addressed reforms in the financial system, in order to provide investors greater security and clarity, and to ensure the proper functioning and transparency of the system. According to international practices to avoid financial risk management, the World Bank points out the need of more effective supervision, combined with greater availability of reliable information regarding operations and agents participating in the system.

While the country experienced substantial financial deepening, financial inclusion has not experienced the same growth. In the advent of the crisis in 1997, financial deepening was at an average level for Latin America. The ratio between portfolio and GDP was 38.7% and, between financial savings and GDP was 43.2%. In 2005, the same indicators were 23% and 36.8%. In contrast, GDP growth was 4% between 2003 and 2005. On the other hand, financial services concentrate in large firms and high income individuals. Only 15% of people belonging to the bottom 40% income share held an account at a formal financial institution and only 41 % of small firms hold a bank loan (Karpowicz, 2014)

One of the biggest problems is the high transaction costs as Colombia ranks 114th in cost of financial services (WEF, 2015). These high transaction costs are due to stringent regulatory requirements (reserves, forced investments), taxes on financial transactions, and high operating costs, which are cash-intensive. The lack of appropriate financial products can be explained by the high fixed operating costs in relation the geographically dispersed population.

Overview of the financial crises

From 1990 to 2005 the financial system in Colombia experienced high volatility. During this period Clavijo et al. (2006) identify the following stages: redesign of the financial system (1990-1993); credit expansion, and mergers and acquisitions period (1994-1995); assets bubbles including mortgages (1996-1997); crisis (1998-2002) and, recovery, except for mortgages (2003-2005).

At the beginning of the 1990's, the diversification of financial services coincided with the credit boom. As a consequence, banks opened several branches country-wide to face the increasing demand for credit. Once the crisis (1998-1999) arrived, an inflexible and high-cost market existed with one consequence being the closing of offices as Leasing Companies and Mortgages Corporations[2]. The last

[2] From 438 financial institutions in 1995 the system ended up with 349 in 1999 and, the total assets of the system were 55.0% of the GDP.

were the most sensitive ones impacted by the crisis which never recovered until they were acquired by Commercial Banks (Carrasquilla, Galindo, and Vasquez, 2000; Urrutia, 2000; Clavijo, 2000).

Mergers and acquisitions at the middle of the 1990's were characterized by twin mergers[3] that contribute to the regional loan diversification but not to the diversification of economic activity as they the mergers and acquisitions did between 2003 and 2005. Other characteristic of the financial system was the conversion of Mortgages Corporations into Mortgages Banks between 2000 and 2003. The activities of these banks involved not only mortgages loans but also foreign currency and consumption businesses. With the later acquisition of these banks by Commercial Banks (2004-2005), the system faced the most important consolidation of its history. The trend of the mergers and acquisitions wave was institutional agreements in which the same commercial banks performed mortgages, commercial, consumption and micro-credit activities; i.e., a full integration of the financial system.

2.3 Regional Level Characteristics

Geographic and economic distances separate Colombian cities. Moving goods from one city to another often requires transport over the Andes and includes navigating altitude differences in excess of 2,000 meters, exacerbating economic distances and increasing logistical costs (Roda and Perdomo, 2011). To reach major ports, goods coming from cities must, on average, be transported about three times further than in Brazil and Chile, and six times further than in Argentina, the Republic of Korea, and China (World Bank, 2015). Bogota and Medellin are more than 500 kilometers away from a port. Figure 2.1, shows the administrative division of the country as well as pavement roads and, Figure 2.2 the quality across regions.

Colombia's growth performance contributed to a small reduction in per capita income disparities, but differences across the country remain, perpetuating historical inequalities (Figure 2.3). Particularly,

[3] Mergers among firms which are involved in the same economic activity looking for scale economies, in contrast with complementary mergers which look for scope economies.

60% of Colombia's regions were able to reduce their per capita income gap with respect to Bogota, and many of those regions are among the poorest ones (World Bank, 2015). However, regional differences are still very large. The five largest regions (Bogota, Valle del Cauca, Antioquia, Atlantico, Norte de Santander) in the country generate approximately 65% of national value added. Regional growth is partially linked to sectorial growth trends and the growth of extractives and services industries[4]. While commodity-producing departments were the main contributors of the small regional convergence effects, the extractive sectors have limited spillover to local populations.

Most of the regions' GDP per capita gap with respect to Bogota is due to low labor productivity. In addition to violence, which has been especially intense in poor regions, poor access to education has been identified as the main bottlenecks harming regional GDP per capita growth and productivity (Lopez-Calva, Castela and Enamorado, 2013; Branisa and Cardozo, 2009; Royuela and Garcia, 2010) . In addition to traditional education, these regions lag behind in entrepreneurial training and continuing education (OECD, 2012). With the quality of transport infrastructure differing greatly across regions, these differences are reflected in the Department Competitiveness Index, which measures basic services, efficiency, sophistication, and innovation (World Bank, 2014)

Institutions have also played a role in per capita income disparities across regions. The new constitution in 1990 sought to promote regional expenditures but failed to reduce inequalities. Sub-national authorities began to receive much larger public resources (especially those linked with oil production) but their capacity to effectively manage and invest them was not raised. As a result, the vast income from oil extraction have been ineffective or misused (Olivera and Perry, 2009).

While per capita income across regions suggests a slow convergence, differences in poverty rates and access to services are persistent. Colombia's moderate and extreme poverty rates have dropped significantly over time. However, regions that already had lower poverty rates had larger poverty

[4] Extractive industries emerge in resource-based economies, dependent on harvesting or extract natural resources for sale or trade (e.g. mining, oil, gas). Services industries, are activities executed by firms for a customer that do not involve manufacturing (e.g. financial services, entertaining, public services)

reduction than regions with higher poverty rates. As a result, differences across regions were maintained and, in some cases, even amplified. Some of the poorest departments (Choco, Cauca and Guajira) have had the smallest declines in poverty rates. Pacific and Atlantic regions have not closed its gap with Valle del Cauca or Bogota. Wealth has been concentrated in manufacturing cities of Medellin, Manizales, and Barranquilla and in the industries of petroleum, petroleum derivatives, beer, and textiles. Differences emerge from differential access to sanitation infrastructure, health services, quality education, road infrastructure and security particularly in departments distant from main city centers or affected by violence.

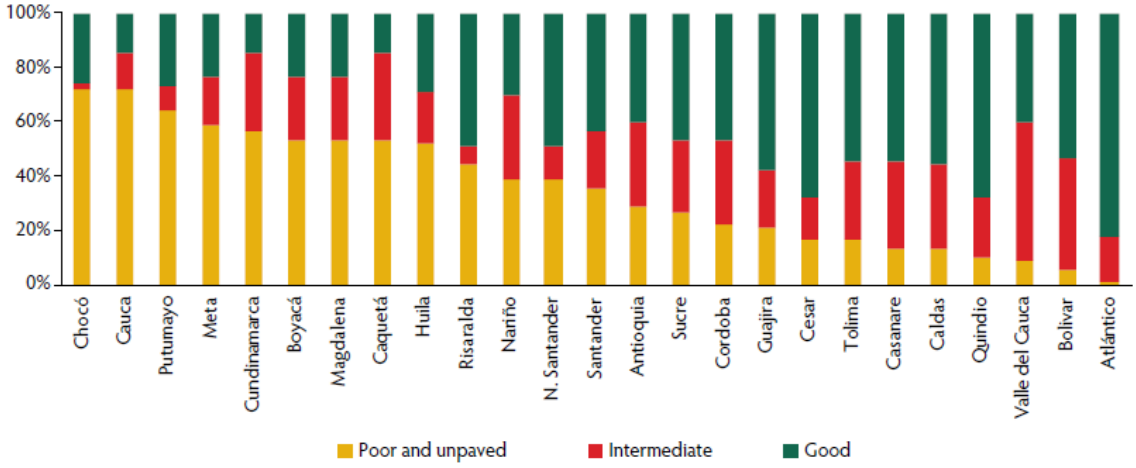
Financial development is one of the pillars for the growth in developing economies and, the challenges are related with the access to credit and financial inclusion. Nevertheless, both are different issues. Access to credit is related with the costs of the services or with the regulatory barriers, legal hurdles, or an assortment of market and cultural phenomena. Financial inclusion is the proportion of household and firms that use financial services (World Bank, 2015). In Colombia, both aspects are creating frictions with international trade and regional integration. The following Section presents a model that describes the impact of credit on exporting decision and amount exporter by firm, with special attention on the differentiated impact by firm size.

Figures

Figure 2.1. Colombia's Administrative Division and Pavement Roads

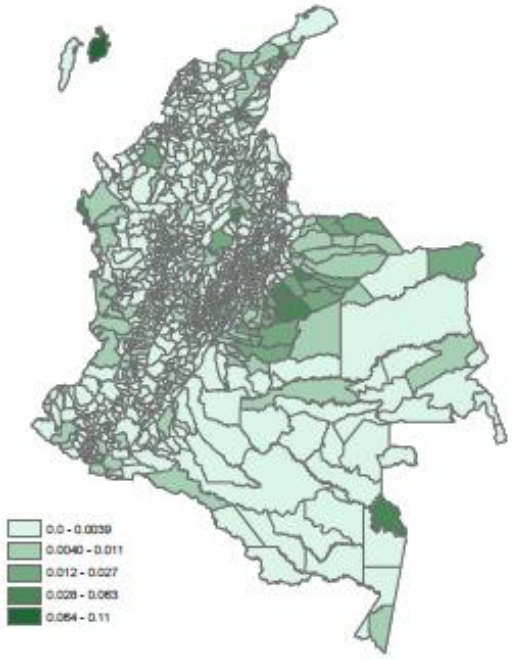
Source: University of Texas at Austin. http://www.lib.utexas.edu/maps/colombia.html

Figure 2.2 Quality of Roads at Department Level



Source: OECD, 2013

Figure 2.3 GDP at City Level



Source: Authors' calculations based on "Department Nacional de Planeacion" (DNP) and "Department Nacional de Estadistica" (DANE)

Chapter 3

The Effect of Credit on the Export Performance of Colombian Exporters[5]

3.1 Introduction

Manufacturers need working capital that is used to pay for upfront costs that are due ex-ante production and sales are realized. When pockets are deep upfront costs are paid with a manufacturer's internal resources, but when the available working capital is limited, an active manufacturer is left with two options: 1) downsize the scale of production until the upfront costs are fully paid with internal resources, or 2) use an external financing source (investor) to meet its capital needs. In the latter case, access to an external financing source not only enables a manufacturer to avoid the under-investment problem of producing at a lower scale, but it also offers him the possibility to be active even in the cases when upfront costs are higher than the available internal resources.

Since exporting manufacturers incur additional upfront costs to service foreign market destinations, access to external sources of financing plays a key role in determining a manufacturer's export success. In line with the recent empirical evidence that links the use of external financing to the firm with a firm's export performance, we use an instrumental variable approach to estimate the credit elasticity of exports for manufacturing firms.

Data for Colombian manufacturers are used[6] to construct a sample that matches detailed manufacturer level information regarding exports, with detailed balance sheet information and matched

[5] Joint work with Danielken Molina

[6] Recent evidence on the real effect of bank financing on export entry is also available for other Latin-American countries. For example, Alvarez and Lopez (2012) use plant level data for Chile, and they find that financial development increases the probability of export participation of a plant, while Castagnino, D'Amato, and Sangiacomo (2013) use firm level from Argentina to show that manufacturers with more access to bank credit are more likely to start exporting. Nevertheless, none of these studies are able to make a causal interpretation of the result.

firm-bank data. A manufacturer's balance sheet information enables us to know the magnitude of the external financing provided by banking institutions, while the matched firm-bank data is used to identify the banking institutions that provided the external financing to the manufacturer. These data also allows us to know the total lending disbursement performed by each financial institution. Together, these data allow us to estimate the bank financing elasticity of exports while controlling for firm-specific and aggregate-specific factors that are also related to a manufacturer's export performance.

Our findings suggest that bank financing has a significant and positive effect on a manufacturer's total volume of exports. We find that manufacturers use bank financing to increase their export market reach denoted by the number of export destinations. However, bank financing does not seem to have the same impact on the export outcomes of all manufacturers. Our results suggest that the positive effect of bank financing on a manufacturer's exports varies by manufacturing size. Bank financing seems to have a higher significant effect on medium-sized manufacturers, operating through all export margins. Medium-sized exporters use bank financing to increase their market reach, market penetration and product mix.

Empirically, our strategy uses the firm-year variation of the credit provided by banking institutions to estimate the bank financing elasticity of exports, while controlling for a manufacturer's prior leverage ratio, and a set of manufacturer and sector-year fixed effects. The use of manufacturer fixed effects sweeps out all the manufacturer specific non-observable factors that do not vary over time, but are related to a manufacturer's export performance and access to bank financing. The sector-year fixed effects control for macro and sector specific factors which in turn are known to affect a manufacturer's export performance and bank financing.

The challenge resides on acknowledging that the estimation of the credit elasticity of exports is subject to a reverse causality bias. While banking credit may lead a manufacturer to export, export

participation may lead a manufacturer to accrue debt with banking institutions.[7] To address this problem, all of our estimates instrument a manufacturer's total demand of banking credit with a supply side instrument that is manufacturer specific. We instrument a manufacturer's banking credit demand with the total loan disbursements of the banks that have a lending relationship with a manufacturing firm. Provided that our matched firm-bank dataset enables us to identify the financial institutions that have a lending relationship with a manufacturer, we use the banks' balance sheet information on total loan disbursements jointly with a manufacturer's information on its financial lending ties to construct a supply side instrument for a manufacturer's demand of banking credit. Our identification strategy uses the supply side determinants of a bank's credit disbursements to isolate a manufacturer's demand of banking credit from the factors determining a manufacturer's export performance. This empirical strategy allows us to estimate the effect of banking credit on a manufacturer's export performance.

In line with the recent and growing trade literature studying the real effects of credit constraints on a manufacturer's export performance, our baseline result suggests that access to external financing in the form of banking credit has a positive and significant effect on a manufacturer's export performance. Although the recent theoretical and empirical literature by Chaney (2005), Muûls (2008), Berman and Héricourt (2010) Manova (2013) and Feenstra, Li, and Yu (2014) supports the idea that access to external financing has a real and positive effect on a manufacturer's export performance,[8] the novelty of this paper resides on using disaggregated financial information at the firm level to determine

[7] Results on the direction of the causality are mixed. For example, Greenaway, Guariglia, and Kneller (2007) use a panel dataset of 9292 UK manufacturing firms, over the period 1993 − 2003, and they find evidence suggesting that participation in export markets improves firms' financial health. On the contrary Bellone, Musso, Nesta, and Schiavo (2010) use French data of 25,000 manufacturing enterprises, over the period 1993 − 2005, and they find that firms staring to export display a significant ex-ante financial advantage compared to their non-exporting counterparts.

[8] While Manova (2013) provides cross country sectoral evidence on the effect of credit constraints in financially developed economies on sectoral export patterns, Muûls (2008), Berman and Héricourt (2010) and Feenstra, Li, and Yu (2014) use firm level data to provide evidence on the negative effect of credit constraints on a manufacturer's export performance.

whether a manufacturer uses external resources to finance it's own operational cycle,[9] rather than relying on standard proxies that the literature uses to infer whether manufacturers rely on external financing or if manufacturers are credit constrained.[10]

Our findings support the concept that external financing to the firm in the form of banking credit not only plays a central role in determining a manufacturer's entry decision into exporting (Chaney, 2005; Greenaway, Guariglia, and Kneller, 2007; Bellone, Musso, Nesta, and Schiavo, 2009 and Berman and Héricourt, 2010), but they also support the concept that manufacturers also use external financing to finance their operational variable cost. Following the literature, our empirical setup relates a manufacturer's export revenue with a manufacturer's size of external financing (Guiso, Sapienza, and Zingales, 2004; Muûls, 2008; Minetti and Zhu, 2011; Manova, 2013; and, Feenstra, Li, and Yu, 2014).[11]

Similar to Amiti and Weinstein (2011) and Paravisini, Rappoport, Schnabl, and Wolfenzon (2011), we take advantage of our matched firm-bank data and we construct a manufacturer-specific supply side instrument for credit demand. But, rather than using supply side variations of bank lending in times economic distress, our empirical estimation uses the variations in the supply side of bank credit to the firm.[12] The notion that supply side shocks matter for loan supply has been already established by previous literature. Using 1990s' data of Japanese banks, Peek and Rosengren (1997, 2000 and 2005)

[9] Unfortunately, when a manufacturer does not use external financing, we cannot differentiate if this was a choice or it was a result of being credit constrained by all the existing banking institutions.

[10] For example, Manova (2013) uses the standard Rajan and Zingales (1998) sectoral financing need to infer if a sector relies intensively on external sources of financing. Muûls (2008) focuses her analysis using a firm level credit score, while Berman and Héricourt (2010) and Feenstra, Li, and Yu (2014) use financial leverage ratios to infer if a manufacturer is credit constrained.

[11] While in Chaney (2005), Muûls (2008) and Manova (2013) a manufacturer's level of debt is taken as given, Feenstra, Li, and Yu (2014) develop a contract theory model of financing where manufacturers endogenously choose their level of external financing and their optimal level of interest rates which enables the creditor to acknowledge a manufacturer's credit type. In a general equilibrium setup, Formai (2013) develops a model where firms finance the costs for product innovation and domestic and foreign market entry with external capital. In this setup credit frictions cause misallocations of resources with significant effect over the export performance of manufacturing firms.

[12] In particular Amiti and Weinstein (2011) and Paravisini, Rappoport, Schnabl, and Wolfenzon (2011) use the change of a bank's financial health in periods of economic distress as an instrument for the change of a manufacturer's demand for credit.

documented that financial health deterioration of Japanese banks led to a short supply of credit to construction firms in the US, with significant higher negative effects on the construction activity in the states that were heavily dependent on the financing provided by the affected Japanese banks. Using aggregate data, Ashcraft (2014) finds that the deterioration of the financial health of banks in Texas led to decrease of the country level output.

Our findings are also linked to the evidence found in the literature of finance and growth suggesting that countries with more developed financial systems have a comparative advantage in sectors with higher dependence on external sources of financing. While Rajan and Zingales (1998), Petersen and Rajan (1997) and Fisman and Love (2003) find that access to external financing has a positive and higher significant effect on the sectoral growth rates of financially dependent sectors,[13] recent evidence by Manova (2013) suggests that the sectoral growth rate of exports is higher for financially dependent sectors when located in financially developed countries. But during economic downturns, Braun and Larrain (2005), Kroszner, Laeven, and Klingebiel (2007) and Dell'Ariccia, Detragiache, and Rajan (2008) show that the short supply of credit has a higher real effect on the growth rates of financially dependent sectors.[14] In the period of the 2009 global economic crisis, evidence by Berman (2009), Iacovone and Zavacka (2009) and Chor and Manova (2012) confirms that most financially dependent exporters were more negatively affected by the short supply in external financing.

This paper contributes to the current literature of trade and external sources of financing to the firm by finding that the positive and significant effect of bank financing on exports varies across manufacturers' size. In particular, we find that the effect of bank financing on a manufacturer's market

[13] While Rajan and Zingales (1998) find that the growth rate of sectors relying more on external financing is higher when located in financially developed economies, Fisman and Love (2003) and Petersen and Rajan (1997) show that in non-developed economies sectoral growth rates are higher for sectors that are more intense in the use of supplier trade debt; an alternative source of external financing to the firm.

[14] A common problem within this literature is that estimates do not address the endogeneity problem between crises and growth. Lower growth rates may deter the ability of agents to repay back loans, so crises may arise as a consequence of low growth rates.

penetration is significantly higher for small- and medium-sized firms, while the effect of bank financing on a manufacturer's export market reach is significantly higher for medium- and large-sized firms. The mixed results suggest that there is a clear distinction on bank financing strategy by firm size. Small- and medium-sized manufacturers use bank financing to increase their product mix, while medium- and large-sized manufacturers prefer to use bank financing to increase their export market reach. We reconcile this finding with the prior evidence of Beck and Demirgüç-Kunt (2006) and Beck, Demirgüç-Kunt, Laeven, and Maksimovic (2006) suggesting not only that access to finance is different by firm size, but these differences translate into growth outcomes that vary by firm size.

This paper is structured as follows: Section 3.2 summarizes why external financing to firms is more important for exporting firms, and also describes the theoretical results embodied by previous models of international trade and firm credit constraints. Section 3.3 provides a description of our dataset and formulates our empirical estimation strategy. Section 3.4 discusses our results; and finally, Section 3.5 concludes.

3.2 External Financing and Related Literature

3.2.1 Relevance of External Financing

Production is a capital intensive activity that requires the payment of upfront costs which are financed using a manufacturer's internal and external resources. When internal resources are limited, external resources become an additional financing source that manufacturers use to accrue the entire upfront costs of production. In this case, access to external financing becomes an important instrument that enables a manufacturer to overcome cash flow needs without affecting its decision on the scale of production. In this sense, domestic and exporting firms are not very different from each other; both require working capital to cover upfront costs.

In comparison when producing for the local market, exporters accrue additional upfront costs. Some of these costs are related to fixed costs of exporting, which affect entry into export market destinations, while others are related to an increase of a manufacturer's marginal cost. The latter may be explained by a variety of reason: a) the rise of per unit charges due to additional transport fees when shipping cargo to a foreign destination, b) the per unit costs increase as manufacturers decide to upgrade a product's characteristics to match consumer preferences in more demanding foreign markets, or c) a manufacturer engages in per unit marketing costs following a sales strategy to position its product in the foreign market.[15] Either way, an increase in a manufacturer's variable cost structure affects its optimal pricing rule which in turn affects its total demand, total export revenue and total export profit.

In addition to paying for additional upfront costs, exporters face additional financing needs due to the mismatch between the time when costs are accrued and the time when revenue from foreign market destinations is realized. Since the timing of payment of these inputs is rarely set to be equal to the timing when export revenue is realized, manufacturers are required to pay for production costs prior to the realization of revenue. With production, transportation, customs' processing and local distribution in the final market requires additional time, exporters need to finance operational costs for at least two additional months beyond the time required by manufacturers producing only for the local market.[16] Exporters are thus more dependent on external sources of financing than domestic producers.

Understanding how exporters use external financing to the firm allows us to determine how financing affects a manufacturer's export market performance. Depending on the financing need, external financing to the firm may only affect a manufacturer's decision to enter into foreign export markets (as in Chaney, 2005), while if debt is also used to finance a manufacturer's variable cost, one

[15] In Arkolakis (2010), marketing costs gives rise to a new margin of adjustment of a country's volume of exports.

[16] According to Djankov, Freund, and Pham (2010), on average it takes 31 days for firms to transport a 20 foot container from its factory doors into a shipping vessel, and another 25 days for firms in the destination country to receive the good at the purchaser's location.

should expect that the financing cost will also impact export revenues through the implied shift in the variable cost (see Muûls, 2008; Manova, 2013; Feenstra, Li, and Yu, 2014). Next we provide a brief overview of the results obtained when heterogeneous productive manufacturing firms are internally financially constrained; hence, they use external financing to fund their fixed and variable costs.

3.2.2 Theoretical Related Framework

Recent literature on international trade accounts for the effects of credit constraints on export market outcomes. In this Section, we use Manova's (2013) baseline model to highlight the effects of external financing on a firm's decision to export and on a firm's export revenue. These findings are used to guide our empirical estimation in Section 3.4.

In Manova's (2013) model, heterogeneous productive exporters finance their total cost structure using internal and external sources of financing to the firm. As in Braun (2003), manufacturers acquire external financing from financial markets by pledging a tangible asset that is only used when a manufacturer fails to honor the financial contract. Under a given demand for external financing and an exogenous probability of repayment, financially dependent exporters choose an optimal pricing rule which among other factors is determined by the return paid to the external investor. Since the cost of capital shifts a manufacturer's variable cost, financially dependent exporters price their products at a higher per unit level. Higher per unit prices decrease demand, which translates into lower export revenues that financially dependent producers are willing to accept at the expense of lower financing costs. This trade off enables financially dependent exporters to export at a scale that, although smaller, is closer in magnitude to the scale achieved if they were not financially dependent.

As proposed, external financing enables a manufacturer to meet the cash flow requirements that they otherwise would not be able to meet, avoiding to shut-down operations due to liquidity constraints. In comparison to this outcome and despite the increase in marginal cost, access to external financing enables the exporter to produce at a higher scale and generate higher revenue.

In terms of entry, a manufacturer self-selects into local and foreign markets when its productivity level is above certain endogenous market specific certain cut-off level. In the context of a model with financially dependent manufacturers, Manova's (2013) model provides four endogenous entry thresholds per destination market. Two determine entry for non-financially and financially dependent local manufacturers, while the other two determine entry for non-financially and financially dependent foreign manufacturers.

Regardless of the original location of manufacturers, the entry threshold for a financially dependent manufacturer lies to the right of the entry threshold for non-financially dependent firms. Meaning that highly financially dependent manufacturers are less likely to self-select into production, as the cost and the magnitude of the external financing makes entry to only be achieved by highly productive manufacturing firms. In this model, financially dependent manufacturers experience a productivity cut-off condition that increases with a manufacturer's level of financial external dependence. Consequently, a highly financially dependent manufacturer are less likely to produce or export, as the endogenous entry conditions are set at a higher level. In this setup external financial dependence is only offset when a manufacturer draws a high productivity, or when the financially dependent manufacturer offers the investor a higher return to secure the external financing.[17] Across sectors, entry into exporting becomes more difficult as sectoral characteristics induce firms to become more dependent upon external sources of financing.

Credit dependence also affects the number of destination countries a firm chooses to serve and the number of products that a firm decides to trade. In terms of destinations, financially dependent firms choose which destinations to service, ranking them from most profiTable to least profiTable. Conditional on the external financing obtained by the firm, the number of destination markets it serves

[17] Unfortunately, this type of setup does not take into account that higher returns imply an endogenous adjustment of the repayment probabilities. Since repayment probabilities are taken as given, the model does not capture the decrease in the probability of repayment caused by rise of a manufacturer's credit dependence, or when exporters accept higher interest rates in return of securing a loan disbursement.

is directly related to how credit dependent the firm is. Highly financially dependent manufacturers are able to export to fewer destinations. Likewise, manufacturers facing external financing constraints will export only the most profiTable products, and will ship fewer products to their foreign market destinations.

To summarize, credit constraints affect both a firm's extensive and the intensive margin of trade. These effects are more pronounced when firms are more dependent on external sources of financing. Understanding how a firm uses external sources of financing allows us to identify the financing sources that may be used to lessen the adverse effects of the cost of external financing on a firm's extensive and intensive margins of trade.

3.3 Data and Empirical Strategy

3.3.1 Data

To relate a manufacturer's current export outcomes to its current external financing sources, we constructed an unbalanced panel dataset using detailed information on exports, financial statements and bank-firm linked data for 2,930 Colombian exporters, classified within the industrial sectors of Agriculture (sectors 1-5) and Manufacturing (sectors 15-39) as defined by the international standard industry classification, ISIC revision 3.1, for the period 1998 − 2006.

Manufacturing export data was extracted from the Transactional Export Dataset (TED) processed by "Direccion de Impuestos y Aduanas Nacionales" (DIAN). TED contains the universe of transactions realized by Colombian exporters at the product level per destination country.[18] From this dataset we extracted annual information on the total value of exports, the market reach - number of export

18 Eaton, Eslava, Kugler, and Tybout (2007, 2008) use this data to provide firm level evidence on the patterns of market reach of Colombian exporters.

destinations -, product mix[19] - number of exported products - and the export market penetration - exports per destination - for the universe of Colombian exporters.

A manufacturer's financial information was extracted from the Financial Statement Database processed by the "Superintendencia de Sociedades" (SS). Although this dataset does not allow us to obtain financial information for the universe of manufacturing firms, it allows us to gather detailed financial information on the type, the term and the currency composition of the external financing of a sub-set of manufacturing firms. Colombian regulations established that there are two reasons why a commercial manufacturer could be included in this data set: First, if at the end of the fiscal year[20] its sales/total assets are higher than a reporting threshold that is set in multiples of the country's yearly monthly minimum wage. Since 1993, the reporting threshold requirement has been modified three times. Decree 1258 of 1993 initially established that firms with only a value of assets over the equivalent of 20,000 times the minimum monthly wage were oblige to report their financial statement to SS.[21] Decree 3100 of 1997 modified the baseline financial account upon which the threshold was set. From this point onwards, the threshold was set to be compared with a manufacturer's total assets or total sales. Decree 4350 of 2006 increased the minimum monthly wage multiple up to 30,000 times the total level of assets or sales of the firm. Meaning that in year 2006, a manufacturer was oblige to report its financial statements to SS if at the end of the fiscal year its level of sales or total assets was above USD5.2 million.[22]

Second, for regulation purposes the superintendent in charge may decide to include manufacturers in the survey even though they fail to meet the minimum reporting threshold upon which they are obliged

19 For robustness purposes, we performed this calculation defining a product line at the 10, 8 and 6 digit level of the harmonized system code product classification.
20 Decree 2649 of 1993 sets December 31st as the end of the fiscal year in Colombia.
21 From 1993 − 1996, commercial manufacturers where only obliged to report their financial statements to SS by only comparing their level of total assets to the level set by the given reporting threshold.
22 In Table 3.1, we report by year the thresholds that are used to determine if a manufacturer is obliged to report its financial statements to SS.

to report their financial statements to SS. Several non-observed reasons may explain the inclusion of these firms within the data set. For example, a direct petition of the stakeholders, or a judicial requirement may require the superintendent to oblige a manufacturer to report its financial statements to SS.[23]

The two rule selection criteria of inclusion into the SS data set not only implies that our data set is mainly composed by medium- and large-sized firms, but it also introduces a bias on a manufacturer's entry decision into producing/exporting. That is, the year when a firm reports financial information to the SS does not correspond to the year when the firm decides to be active. Across time, when a firm fails to be included within the SS database, it does not imply that the corresponding manufacturer has decided to exit the market; it only means that a manufacturer's sales/assets size does not meet the selection reporting criteria. For our empirical exercise, we cannot use the data to study the self-selection process into producing/exporting, but we can use the data to investigate the relation between a manufacturer's external financing choices and a manufacturer's export outcomes. In this context, our empirical strategy requires accounting for the selection bias to include a manufacturer in the database.

A manufacturer's information on sources of financing was used to construct a bank-firm linked dataset that we built using Superfinanciera's financial format 341 and the banks' balance sheet information. We used Superfinanciera's format 341 to obtain yearly information of the financial institutions that are effectively providing credit to manufacturing firms. We matched this dataset with a bank's information on the yearly total loan disbursements, and we obtained a manufacturer specific variable that we use as a supply side instrument for credit demand.[24]

[23] We would like to thank Marcela Eslava for sharing detailed information on the entry selection criteria into the SS's database.
[24] Sub Section 3.2 provides detailed explanation on the construction and use of the financing supply side instrument.

3.3.2 Export Outcomes and External Financing

Table 3.2 reports summary statistics for our firm-year unbalanced panel data set that we construct using firm-level export outcome data, firm-level balance sheet information, and bank-firm linked information. Our dataset includes 11,191 observations, for a sample of 2,930 manufacturing exporters classified within industrial sectors of Agriculture (sectors 1-5) and Manufacturing (sectors 15-39) as defined by the international standard industry classification, ISIC revision 3.1, for the period 1998 − 2006. The available information within the SS's database enable us to construct an unbalanced database containing 38.4% of the universe of Colombian exporters, which in turn represents on average 72.1% of Colombia's total export volume (per year results are reported in Table 3.3).[25] This percentage corresponds to almost the country's total export share achieved by manufacturers classified in the economic sectors that are not related to the extraction of petroleum, gas and coal; which in the case of Colombia represents on average 28% of the country's yearly exports.

On average, a Colombian manufacturer exports a total volume of USD312,000, with a reported export market penetration of USD82,500, an average export market reach of six countries and an average product mix equal to 8 products.[26] A manufacturer's average size is around USD5.7 million, with an asset tangibility equivalent to 20% of a manufacturer's average size and an average leverage ratio equal to 49% of a manufacturer's total assets. While a manufacturer's active financing is on average provided by three different financing institutions, our evidence suggests that a manufacturer's access to finance may be concentrated, as 25% of the sample of manufacturers obtains external financing from only one financing institution.[27]

[25] Although the database only matches at most 44% of the country's number of exporters (year 1998), the match on the total value of exports is high, and it is in line with recent evidence by Freund and Pierola (2012) where regardless of the country, custom level data around the world reflects a concentration of a country's level of exports. As reported by the authors, the top 1% of Colombian exporters concentrate nearly 51% of the country's total volume of exports.

[26] Measured at the 6, 8 and 10 digit level of the harmonized system code. For details, refer to Table 3.2.

[27] Corresponding to the number of financing institutions evaluated at the 25th percentile; see Table 3.2.

Although a manufacturer can obtain external financing from different sources, (e.g. standard debt loans, supplier trade debt, equity and other financing sources), the empirical evidence for Colombian exporters reveals a concentration on the financing source type. Almost 61% of a manufacturer's total liability is financed using bank credit and supplier trade debt. Bank financing accounts to 33% of a manufacturer's total liabilities, while supplier trade debt accounts up to 28% of a manufacturer's total liabilities.[28] The term structure of a manufacturer's external financing supports the idea that manufacturers use external financing to finance their cash flow requirements for production, as 52% of a manufacturer's total liabilities are short term. While 50% of this short-term financing is provided by domestic financing institutions, 37% is provided by domestic suppliers.

Across manufacturers, the characterization of the sources and term structure of external financing reveals differences on the type of financing used to meet a manufacturer's cash flow requirements. As reported in panel B in Table 3.2, we classified manufacturers by size using Colombia's asset classification criteria as given by Law 590 of year 2000.[29] Although Colombia's current manufacturer size classification is determined by law 905 of 2004, the sample period of our database implies that 70% of the firm-year observations were subject to the size classification given by Law 590 of year 2000. Hence, we use the total asset thresholds as determined by Law 590 of year 2000 to classify a manufacturer within one of the following three size categories: 1) Small: when a manufacturer's level of total assets is lower than USD 2.5 million. 2) Medium: when a manufacturer's level of total assets is between USD 2.5 million and USD 5.1 million, and 3) Large: when a manufacturer's level of total assets is greater than USD 5.1 million.[30]

[28] The other 49% is composed by liabilities not related to production; two examples are differed debt to workers and other liabilities.

[29] Since late 1980's, the size classification criteria has been modified in three opportunities: 1) Law 78 of 1988. 2) Law 590 of 2000 and 3) Law 905 of 2004.

[30] Originally, Law 590 of year 2000 determines that the thresholds used to determine a manufacturer's size classification are based on a cutoff level given in multiples of the country's yearly minimum wage (ymw). Large manufacturers are those whose level of total assets is greater than 30,000 ymw. Medium manufacturers are those whose level of total assets is within the bracket of 15,001 − 30 000 ymw. Small manufacturers are those whose

We not only find that export performance increases with size (see Figure 3.1(a)), but we also find that there are also significant differences in the type and the terms upon which manufacturer's use external financing. Small manufacturers have a higher percentage of tangible assets; they exhibit a higher lever- age ratio despite having a lower level of bank debt, and having a lower number of financing ties. Though, the higher leverage ratio of small manufacturers seems to be explained by their higher use of supplier trade debt. In contrast, large manufacturers tend to rely more on bank financing, as their total debt ratio is 8 percentage points higher than the observed for small manufacturers. A manufacturer's different financing choice may be partially explained by the relative cost of bank debt. As reported in Figure 3.1(c), credit interest rates are higher for small manufacturing firms than they are for large manufacturing firms. We now turn to test whether these financing patterns are related to a manufacturer's export performance.

3.3.3 Empirical Strategy

Our objective is to test whether a manufacturer's current external bank financing $bloan_{i.s.t}$ has a positive and significant effect on a manufacturer's current export outcomes $y_{i.s.t}$ Our baseline specification is

$$\ln y_{i,s,t} = \beta_0 + \beta_1 \ln bloan_{i,s,t} + \beta_2 levrat_{i,s,t-1} + \Lambda_i \gamma' + \Gamma_{s,t} \delta' + \varepsilon_{i,s,t} \qquad (3.1)$$

where sub-indexes *i, s, t* refer to a manufacturer *i*, classified within the industrial sector *s* at time *t.* $y_{i.s.t}$ corresponds to a manufacturer's total value of exports, but provided that its total export revenue may be decomposed into its export margins, we extend our baseline specification by testing whether current bank financing also affects a manufacturer's export margins. Therefore, $y_{i.s.t}$ not only represents a

level of total assets is within the bracket of 5,001 − 15,000 ymw and Micro-manufacturers are those whose level of total assets is below 5,000 ymw. The calculations included in the text are obtained using the implied ymw in US dollars of year 2006 as reported in column 4 of Table 3.2. Since the country's ymw. Changes by year, in our estimates a manufacturer's size classification varies through time not only because the implied threshold level changes with each year's minimum wage level, but also because a manufacturer's total asset value also varies through time.

manufacturer's total export revenue, but it also represents a manufacturer's export market reach (number of export destinations), a manufacturer's export market penetration (exports per destination) and a manufacturer's product mix (number of exported products). These are measured at the 6, 8 and 10 digit level of the harmonized system code.

Provided that a manufacturer's current external financing comes from a wide set of investors; i.e. bank financing, equity finance, supplier trade debt or loans from non-financial institutions or other individual investors. In all of our specifications $bloan_{i.s.t}$ corresponds to the current total value of new loan disbursements given by banking institutions; $bloan_{i,s,t} = \sum_{b \in B} bloan_{i,s,t}$, where b identifies the bank providing the external financing and B is the set of banks in the database. The reason to only focus on current bank financing is based on the evidence that Colombian manufacturers use bank financing as their main external financing source, while the use of other financing sources represents less than 4% of a manufacturer's total liabilities[31].

All of our estimates control for a manufacturer's ex-ante leverage ratio $levrat_{i,s,t-1}$ which we use to control for manufacturer specific credit constraints that limit its own current export performance and current bank credit access. We also include a set of firm fixed effects Λ_i and a set of year fixed effects Γ_t. The use of manufacturer fixed effects enables us to sweep all the manufacturer specific non-observable factors that do not vary through time and are related to a manufacturer's export performance and to a manufacturer's access to current bank financing. Year fixed effects control for non-observable macro factors that are known to affect a manufacturer's export performance and a manufacturer's demand for bank financing. As an alternative, one may also would like to control for non-observable macro factors that are sector-year specific which in turn affect a manufacturer's export performance and credit demand. Hence, our results also include estimates that instead of including year fixed effects

[31] See debt ratios of equity and other financing sources reported in Table 3.2

include sector-year fixed effects. In addition, all of our estimates cluster standard errors using a manufacturer's industry classification - 4 digit level, ISIC revision 3.1-.

Even though the use of external financing implies an increase of a manufacturer's marginal cost that is equal to the cost of financing (credit interest rate), one should also take into account that external financing may also imply a decrease of marginal cost due to the scale effect of production. When there are increasing returns to scale, the marginal cost of production decreases with the scale of production. When externally financed, the scale of production is higher than the level obtained when production is limited by a manufacturer's internal financing. If the savings due to the scale effect of production are higher than the marginal cost increase due to the cost of financing, one should expect that $\hat{\beta}_1 > 0$.

3.4 Estimation Problems

Empirically, there are several factors affecting the correct estimate of coefficient $\hat{\beta}_1$. First, the estimated magnitude of $\hat{\beta}_1$ is subject to a reverse causality bias. While banking credit may lead a manufacturer to export, current export participation may lead a manufacturer to accrue current debt with banking institutions. Second, the correct estimation of parameter $\hat{\beta}_1$ should account for the selection criteria to include a manufacturer into SS's data set produces a sampling of manufacturers that is non-random (see Wooldridge, 2002; chapter 17). This implies that when estimating (3.1) one not only should take into account the reverse causality problem, but one should also take into account that there is an incidental truncation problem that if significant may make the estimates of parameter $\hat{\beta}_1$ to be inconsistent.

We address these problems by re-setting the estimation of (3.1) as:

$$\ln y_{i,s,t} = \beta_0 + \beta_1 \ln bloan_{i,s,t} + \beta_2 \ln levrat_{i,s,t-1} + \Lambda_i \gamma' + \Gamma_{s,t} \delta' + \varepsilon_{i,s,t}, \quad (3.2.1)$$

$$\ln bloan_{i,s,t} = \eta_0 + \eta_1 \ln sloan_{i,s,t} + \eta_2 \ln levrat_{i,s,t-1} + \Lambda_i \theta' + \Gamma_{s,t} \mu' + \xi_{i,s,t} \quad (3.2.2)$$

$$y_{1,i,j,s,t} = \mathbb{I}\{z_{i,j,s,t} \lambda' + \Lambda_i \alpha' + \Gamma_{s,t} \rho' + \upsilon_{i,,s,t} > 0\} \quad (3.2.3)$$

(3.2.1) is our equation of interest. (3.2.2) is the linear projection that we use to address the reverse causality problem of bank lending and (3.2.3) is the selection equation that we use to correct for the non-random sampling of SS's dataset. The variables ln $sloan_{i,s,t}$ and $z_{i,s,t}$ are the instruments that we use to address the reverse causality problem and the incidental truncation problem. While Λ_i and $\Gamma_{s,t}$ are a manufacturer and year/sector-year fixed effects, and $\varepsilon_{i,s,t}$, $\xi_{i,s,t}$ and $\upsilon_{i,,s,t}$ are the corresponding error terms with $\upsilon_{i,,s,t} \sim$ N(0, 1).[32]

As proposed by (3.2.2), in all of our specifications we instrument a manufacturer's current bank lending with a manufacturer specific supply side instrument of bank credit that we construct using the bank-firm matched data set. Provided that this data set contains information on the financial institutions that have a lending relationship with a manufacturer, and given that from a bank's balance sheet information we extract a bank's total loan disbursements $sloan_{b,s,t}$, we use these data to construct four supply side instruments of bank credit $sloan_{i,s,t}$. The first instrument is equal to the sum of the loan disbursements executed by all banking institutions that have a commercial banking relationship with the manufacturing firm (i.e. $sloan_{i,s,t} = \sum_{b \in B} sloan_{b,s,t}$). Since banks decisions may be tied to political interventions[33], in the second instrument, we just consider private banks (i.e. $sloan_{i,s,t} = \sum_{b \in B_{private}} sloan_{b,s,t}$). Third instrument is the historical average of the disbursements all banking institutions and the fourth instrument is the historical average on private banks. Since one may think that the credit demand of big manufacturers may affect a bank's overall supply of credit, for each manufacturer of each supply side instrument is net of a manufacturer's own credit demand obtained from these banks.

To sum up, our identification strategy uses a bank's supply side determinants of credit disbursements to isolate a manufacturer's demand of banking credit from the factors determining a

[32] Additional assumptions require that $\varepsilon_{i,s,t}$ and $\upsilon_{i,,s,t}$ are independent of $z_{i,s,t}$ and that $E(sloan'\xi) = 0$

[33] Intervention in the form of banks ownership expands credit availability with possible cost of imprecise screening (Song and Thakor, 2012)

manufacturer's export performance. We expect that the first stage results of $\hat{\eta}_1$ should be significantly greater than zero.

We use (3.2.3) to address the non-random sampling problem that affects the selection of manufacturers into SS's database. In this context $y_{1,i,s,t}$ is an indicator variable that takes the value of one when $z_{i,s,t}\lambda' + \Lambda_i\alpha' + \Gamma_{s,t}\rho' + \upsilon_{i,s,t} > 0$, where $z_{i,s,t}$ is a manufacturer-year specific exogenous instrument that determines whether in a given year a manufacturer is included in the data set. Provided that the SS's superintendent has discretionary power to oblige a manufacturer to report its financial statements even though it may not meet the exogenous threshold condition to report, and given that within a ten-year period the SS's superintendent has changed to every two years, we use a superintendent's term in office as an instrument for a manufacturer's inclusion into SS's data set. Hence, $z_{i,s,t}$ in (3.2.3) is a matrix with four dummy variables. Each variable takes the value of one during the term when a given superintendent was in office. Since superintendents are in office for more than a year, and given that their term in office does not correspond to a calendar year, one does not expect that the set of year fixed effects will absorb the significance of the coefficients linked to the term in office instruments.

While $y_{1,i,s,t}$ and $z_{i,s,t}$ are always observed, $\ln y_{i,s,t}$ and $\ln bloan_{i,s,t}$ are only observed when $y_{1,i,s,t} = 1$. Our estimation procedure is applied as follows: First, we estimate parameters $\hat{\lambda}'$, $\hat{\alpha}'$ and $\hat{\rho}'$ in (3.2.3) with a probit of $y_{1,i,s,t}$ on $z_{i,s,t}$ using all the observations. Second, after testing for the significance of our term in office instruments, we proceed to estimate the inverse mills ratio $\hat{\lambda}^M_{i,s,t} = \frac{\phi(z_{i,s,t}\lambda' + \Lambda_i\alpha' + \Gamma_{s,t}\rho')}{1-\Phi(z_{i,s,t}\lambda' + \Lambda_i\alpha' + \Gamma_{s,t}\rho')}$. Third, we proceed to estimate (3.2.1) using an standard 2SLS estimation procedure on the observations where $y_{1,i,s,t} = 1$, while including the inverse mills ratio which is set to control for the sample selection bias. In other words we proceed to estimate:

$$\ln y_{i,s,t} = \beta_0 + \beta_1 \ln bloan_{i,s,t} + \beta_2 \ln levrat_{i,s,t-1} + \beta_3\hat{\lambda}^M_{i,s,t} + \Lambda_i\gamma' + \Gamma_{s,t}\delta' + \varsigma_{i,s,t} \qquad (3.3)$$

using a standard IV estimation approach that deals with the reverse causality problem between $\ln y_{i,s,t}$ and $\ln bloan_{i,s,t}$. At this stage we need to test if our supply side instrument is significantly different from zero ($\hat{\eta}_1 \neq 0$), and if the estimate of $\hat{\beta}_3$ is statistically different from zero. If we fail to reject that $\hat{\beta}_3 \neq 0$, we find that the sample selection bias in the SS dataset is not significant, and estimates of (3.1) can be carried out by implementing a standard 2SLS without requiring to control for the sample bias.

The observed differences in the financing patterns by size lead us to extend our baseline specifications by testing whether the estimate magnitude of $\hat{\beta}_1$ in (3.3) differs across manufacturers' size. Prior evidence by Carpenter and Petersen (2002), Beck and Demirguc-Kunt (2006), and Beck, Demirgüç-Kunt, Laeven, and Maksimovic (2006) supports the view that access to credit is more difficult for small and medium sized firms. Hence, one should expect that the estimated credit elasticity of export outcomes should vary by manufacturer size.

3.5 Results

3.5.1 Overall Evidence

Tables 3.5 through 3.8 report the results for our benchmark specification as proposed in (3.2.1) – (3.2.3)[34]. We estimate the credit elasticity of exports outcomes, where export outcomes are measured by an exporter 1) total export volume (Table 3.5) market reach (Table 3.6) market penetration (Table 3.7) and product mix (Table 3.8). In all Tables column (1) corresponds to the results obtained when we do not take into account the estimation problems discussed. Columns (2) − (4) report the results obtained when we follow the self-selection estimation approach with some differences. While columns (2) and (3) only take into account the reverse causality problem using an standard IV approach with year and

[34] From the four instruments mentioned in Section 3.5, we find that disbursements executed by all banking institutions, is the most consistent instrument across all estimations.

sector-year fixed effects, column (4) reports the results obtained when we also control for the sample selection bias using the inverse mills ratio that we calculate after estimating (3.2.3). In columns (2) − (4), we include the first stage results on the coefficient of credit supply and we include the corresponding F-statistic that we use to determine whether our instrument in the first stage is weak.

Since column (4) is the only specification that controls for the entry selection problem, we also include a joint significance test of the relevance of the estimated coefficients for the instruments of term in office that we use to estimate the probit specification.

Results in Table 3.5 are in line with the theoretical findings that current access to bank financing enables a manufacturer to increase its current export revenue. Not only the estimated coefficient for current bank financing is positive and significant at 5% in all specifications, but our results suggest that disregarding the reverse causality problem between exports and bank credit produces a downward bias in the estimated coefficient that is corrected once we use our manufacturer specific supply side instrument as reported in column (2). The first stage results on the significance of our instrument not only suggests that our supply side instrument is relevant, but the reported magnitude of the estimated F-statistic suggests that our estimation strategy does not suffer from a weak instrument problem as the estimated value of the F-statistic is in all cases greater than 10 (Stock, Wright, and Yogo, 2002). Results in column (4) show that the sample selection bias of the SS's data set is not statistically different from zero as the significance of the inverse mills ratio fails to be different from zero. One may wonder if this is because the instruments in the selection equation are not significant. Although we do not report the estimates of the probit estimate, we report the F-statistic associated to the joint test on the significance of the instruments that we use to characterize the sample selection into the SS's data. The term in office instruments in the probit specification are jointly significantly different from zero. Hence, the lack of significance of the inverse mills ratio in column (4) implies that estimating (3.1) following the standard IV estimation approach to deal with the reverse causality bias will produce consistent estimates for $\hat{\beta}_1$. Hence, our estimates in column (3) suggest that an increase in a manufacturer's bank financing debt

level from the sample average to the level obtained at the 75th percentile implies an increase of manufacturer's export revenue of 63.1%.[35]

Our detailed export data enables us to test whether the effect of bank financing on a manufacturer's export revenue is channeled through a specific export margin. The available export information extracted from the TED allows us to calculate a manufacturer's market reach, market penetration and product mix at three different levels of aggregation of the harmonized system code. Tables 3.6 and 3.7 report the results obtained when testing for the effect of current bank financing on a manufacturer's market reach and on a manufacturer's export market penetration. Table 3.8 reports the results obtained when testing for the effect of bank financing on a manufacturer's product mix, given three alternative definitions to of the head count of products.

Results in Table 3.6 support the idea that current bank financing has a significant effect on a manufacturer's decision to export to more foreign destinations. The reported first stage results in columns (2) − (4), not only validate the significance of our instrument, but also suggests that our estimation strategy does not suffer from an estimation bias due to the use of a weak instrument. Column (4) confirms that the sample selection bias does not affect the overall estimates of bank-credit coefficient. The estimated coefficient in column (3) suggests that increasing a manufacturer's bank financing debt level from the sample average to the level obtained at the 75th percentile increases a manufacturer's number of export destinations by 24.6%, the equivalent to 2 additional destinations.[36]

[35] The estimated percentage increase of a manufacturer's exports is obtained using the percentage increase of bank financing when moving from the sample average up to the level observed at the 75th percentile joint with the estimated coefficient of the current New Bank Financing reported in column (3)-Table 3.5. Thus, a manufacturer's export revenue increase of 63.1% = $\hat{\beta}_1 * \%\Delta bloan_{75-50}$. Provided that $\hat{\beta}_1$= .059 and $\%\Delta bloan_{75-50} = \left[\frac{bloan_{75}}{bloan_{50}} - 1\right] * 100$, where $bloan_{75}$ and $bloan_{50}$ correspond to the level of bank financing at the 75th and the 50th percentile reported in log scale in Table 3.2.

[36] The estimated percentage increase of a manufacturer's exports is obtained using the percentage increase of bank financing when moving from the sample average up to the level observed at the 75th percentile joint with the estimated coefficient of the current New Bank Financing reported in column (3)-Table 6. Thus, a manufacturer's export revenue increase of 28.9% = $\hat{\beta}_1 * \%\Delta bloan_{75-50}$. Provided that $\hat{\beta}_1$= .027 and $\%\Delta bloan_{75-50} =$

However, our estimates on market penetration (7) and the product mix (8) reveal that bank financing does not have any significant effect in affecting these export margins.

3.5.2 Evidence by Manufacturing Size

Since our data reveals that there are significant differences on the financing sources used by manufacturing firms when characterized by size, we extended our benchmark estimates by testing whether the effect of bank financing on a manufacturer's export outcomes vary by firm size. Following the same estimation approach that we lay out in (3.2.1)− (3.2.3), we first test whether bank financing has a different effect on a manufacturer's export revenue when exporters are characterized by size. Second, we continue to test whether the effect of bank financing operates throughout a particular export margin, and if so, we test if there are significant differences of the effect across manufacturer's size.

Although we know that estimating (3.1) under the standard IV procedure provides consistent estimates of the bank financing parameter, in Tables 9 − 12 we continue to report the results obtained even when we control for the sample selection bias. In all Tables columns (1)−(3) correspond to the effect of bank financing when we only address the reverse causality problem while columns (4) − (6) correspond to the results when we include the inverse mills ratio in the estimates. In all Tables we confirm that omitting the sample selection correction parameter (inverse mills ratio) does not produce a bias on the $\hat{\beta}_1$. Hence, we focus our analysis on the results reported in columns (1) − (3).

As reported in Table 3.9, bank financing has a differential effect on the export revenue of medium-sized manufacturers. The estimates in column (2) suggest that increasing bank financing from the sample average up to the level observed at the 75th percentile produces an export increase of 63%. The differential export increase of medium-sized manufactures is not only explained by an increase in market reach, but it is also explained by an increase on market penetration and product mix. Reported results in

$\left[\frac{bloan_{75}}{bloan_{50}} - 1\right] * 100$, where $bloan_{75}$ and $bloan_{50}$ correspond to the level of bank financing at the 75th and the 50th percentile reported in log scale in Table 3.2.

column (2) in Tables 9 through 12 show that an increasing bank financing from the sample average up to the level observed at the 75th percentile produces a market reach increase equivalent to 1.5 destinations; produces an increase of market penetration equivalent to 37.6%, and produces an increase on its product mix equivalent to 2 new products. Our results only find that bank credit has a significant effect on the market reach of large manufacturing firms. In the case of small manufacturers, we do not find significant differential benefits of access to credit.

3.5.3 Evidence by Product - Country Destination

Since some authors argue that the positive correlation between trade flows and credit granted at the firm level seem to be explained by firm's characteristics and demand factors (Berman and Hericourt, 2009; Buono and Formai, 2013) we extend previous analysis in two ways: product-country destination (Tables 3.13 and 3.14) and industry (Table 3.15). Given in aggregate estimations, we do not find evidence of selection bias, the following estimations lay out in (3.2.1) − (3.2.3), where we test whether the impact of bank financing on a manufacturer's product mix considering 6 and 10 digits of disaggregation and country destination.

Opposite to Section 3.6.1, results in Tables 3.13 and 3.14 show that current access to bank financing enables a manufacturer to increase its current export revenue through the product mix. The estimated coefficient for current bank financing is positive and significant at 5% and, consistent with previous estimations, our results suggest that disregarding the reverse causality problem between exports and bank credit produces a downward bias in the estimated coefficient that is corrected once we use our manufacturer specific supply side instrument as reported in column (2). In Table 3.14 we do robustness check by indicating that observations are clustered into industries (column (1)), country destination (column (2)), industry-country destination dyad (column (3)) and, industry and country destination (column (4)).

To analyze the impact of the demand at industry level we follow two strategies: a) split the estimations by two digits of disaggregation and b) split the estimations according to Rauch classification. Rauch (1999) classifies industries according to three possible types: differentiated products, reference priced, or homogeneous goods. Unfortunately, the first strategy does not provide consistent results. We claim this is the outcome of a sample overrepresented in some industries. Considering the over- or sub-representation of industries in the sample we present the most consistent results, which are by grouping the sample according to Rauch classification. In Table 3.15, we present the estimations of homogenous goods (column (1)), referenced prices and differentiated products (column (2)), differentiated goods (column (3)) and reference priced (column (4)). We find that banking finance has positive and significant effect at 5% level on differentiated products. Our results indirectly evaluates the role of information cost and, align with literature that considers these costs primary operate with respect differentiated products.

Finally, we assess the impact of banking finance at the firm level considering our new level of disaggregated data, product-country destination and, differentiated by size percentile. Figure 3.2, shows the results of the percentile regression by 10 digits of disaggregation[37]. Consistent with results of Section 3.6.2, we find that external finance has a positive and significant impact for small- and medium-sized firms. Interesting, we find a non-linear relationship that suggest banking has greater impact on smallest firms.

[37] Direction of results do not change at 6 digits of disaggregation.

3.6 Conclusions

Recent theoretical and empirical research on international trade provides evidence of the importance of external financing for exporters. As explained by Chaney (2005), Muûls (2008), Paravisini, Rappoport, Schnabl, and Wolfenzon (2011), Manova (2013) and Feenstra, Li, and Yu (2014), financing fixed costs of exporting with external financing sources only affects the entry decision into exporting, while the pricing, and export revenue are not affected. However, when variable costs are financed with external sources of credit, one may find that the external financing has a significant effect on an exporter's export revenue, and on an exporter's export margins.

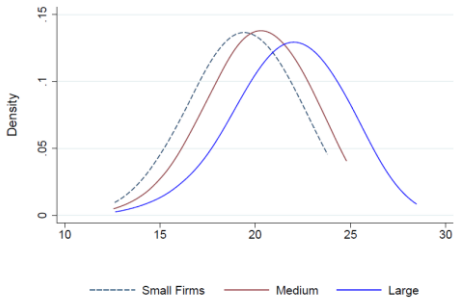
Inspired by this literature, in this paper we use detailed manufacturer and bank-firm linked data to construct a database that allows us to test whether current access to bank financing has a significant effect on the current export revenue of manufacturing firms. We also test whether this external financing has a significant effect on export margins as measured by market reach, market penetration and product mix. Finally, we test whether the effect of current bank financing on a manufacturer's current export outcomes may vary by manufacturer size.

Our empirical results suggest that access to current bank financing has a positive and significant effect on a manufacturer's current export outcomes. Initial results suggest that current bank financing increases a manufacturer's current export revenue. We find that this effect is mainly channeled through the increase of its market reach.

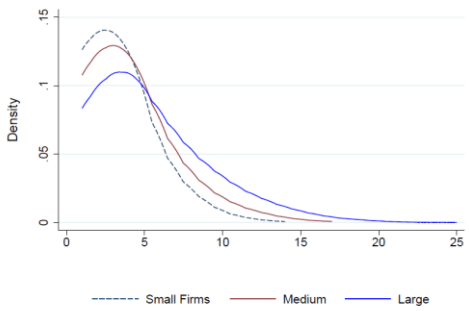
Across manufacturer size, we find evidence supporting the view that the effect of current bank financing on a manufacturers export outcomes varies by size. Small- and medium-sized exporters are the ones who benefit the most from bank financing as we find that their export revenue increase because the export to more destination, they export more per destination and they export new products.

Figures

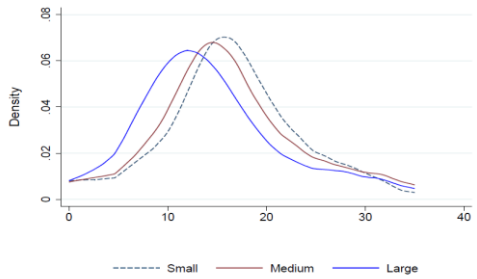
Figure 3.1. Financing Terms by Manufacturing Size



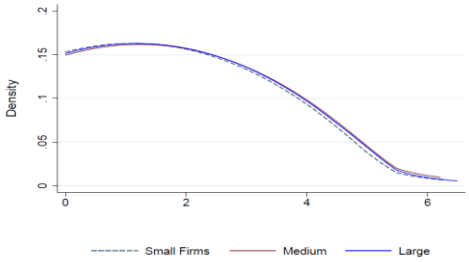
(a) Total Exports (ln)



(b) # of Financing Ties



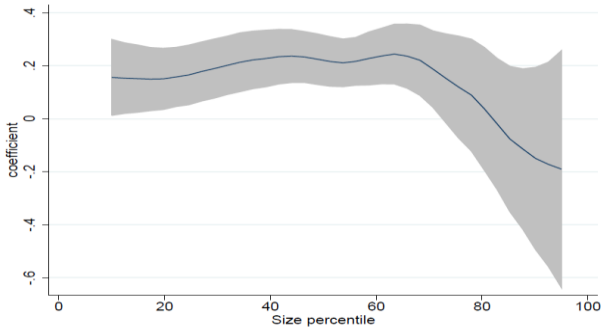
c) Interest Rate



d) Collateral as % of Debt

Source: Own authors' Calculations. Note: Data on a manufacturer's export volume was extracted from TED. Data on a manufac- turer's number of financing ties, loan interest rates and collateral size by financing need were extracted from SS's format 341. A manufacturer's size classification corresponds to the asset size criteria determined by Law 590 of 2000

Figure 3.2. Percentile regression by 10 digits HS



Source: Own authors' Calculations. Note: Data on a manufacturer's export volume was extracted from TED. Data on a manufacturer's number of financing ties, loan interest rates and collateral size by financing need were extracted from SS's format 341. A manufacturer's size classification corresponds to the asset size criteria determined by Law 590 of 200

Tables

Table 3.1. Yearly Minimum Wage in Colombia and Yearly Entry Threshold Criteria into SS Database

Year	Decrete[a]	Monthly (Col. Pesos)	Monthly (US. Dollars)	Reporting (US - Dollars)
1998	3106, December	203.826	14,293	2,858,634.75
1999	2560, December	236.460	13,464	2,692,812.25
2000	2647, December	260.100	12,457	2,491,494.00
2001	2579, December	286.000	12,437	2,487,353.25
2002	2910, December	309.000	12,339	2,467,813.25
2003	3232, December	332.000	11,537	2,307,436.25
2004	3770, December	358.000	13,619	2,723,870.00
2005	4360, December	381.500	16,438	3,287,611.00
2006	4686, December	408.000	17,280	5,183,938.00

a As reported by the Central Bank of Colombia in http://obiee.banrep.gov.co/analytics/saw.dll?Go&Path=/shared/Consulta%20Series%20Estadisticas%20desde%20Excel/1.%20Salarios/1.1%20Salario%20minimo%20legal%20en%20Colombia/1.1.1%20Serie%20historica&Options=rdf&NQUser=salarios&NQPassword=salarios&lang=es.

b For calculation purposes we use the yearly average level of the exchange rate (col-pesos/us-dollar) as reported in the IMF's International Financial Statistics Database (IFS).

c Until 2005, the threshold was set at 20, 000 times of the corresponding yearly monthly minimum wage. Since 2006, the threshold was modified to 30, 000 times of the corresponding yearly monthly minimum wage. The Reporting threshold is equal to the product of the minimum wage in Colombia in US dollars and the threshold expansion factor as previously defined.

Table 3.2: Summary Statistics

Panel A: Summary Statistics All Manufacturers

Variable	Obs.	Avg.	Std. Dev.	Min.	Max.	Perc. 25	Perc. 75
Tot Value of Exports (ln)	11,191	12.651	2.613	4.605	20.703	10.874	14.550
Export Market Penetration (ln)	11,191	11.320	2.010	3.912	19.150	10.026	12.640
Export Market Reach	11,191	6.070	6.187	1.000	57.000	2.000	9.000
Product Mix (hs 6 digit level)	11,191	8.215	13.710	1.000	208.000	1.000	9.000
Product Mix (hs 8 digit level)	11,191	8.784	14.690	1.000	217.000	2.000	9.000
Product Mix (hs 10 digit level)	11,191	8.902	14.750	1.000	217.000	2.000	10.000
Total Assets (ln)	11,191	15.563	1.555	10.164	22.422	14.474	16.540
Total Bank Financed Debt (ln)	11,191	12.892	4.455	0.000	20.657	12.398	15.356
Asset Tangibility Ratio[a]	11,190	0.201	0.157	0.000	0.931	0.081	0.283
Leverage Ratio[a]	11,191	0.494	0.258	0.006	4.499	0.327	0.634
# of Active Financing Relations	11,191	2.786	2.595	0.000	19.000	1.000	4.000
# of Historical Financing Relations	11,191	3.980	3.173	1.000	25.000	2.000	5.000
Ratio Total Debt with Banks[b]	11,191	0.324	0.235	0.000	0.988	0.113	0.511
Ratio Total Debt with Domestic Banks[b]	11,191	0.305	0.229	0.000	0.988	0.097	0.486
Ratio Total Debt with Foreign Banks[b]	11,191	0.019	0.081	0.000	0.940	0.000	0.000
Ratio Total Debt with Suppliers[b]	11,191	0.281	0.197	0.000	0.997	0.132	0.393
Ratio Total Debt with Domestic Suppliers[b]	11,191	0.181	0.163	0.000	0.975	0.058	0.259
Ratio Total Debt with Foreign Suppliers[b]	11,191	0.100	0.165	0.000	0.997	0.000	0.130
Ratio Other Debt[b]	11,191	0.032	0.086	0.000	0.928	0.000	0.014
Ratio Equity Debt[b]	11,191	0.003	0.029	0.000	0.532	0.000	0.000
Ratio Short Term Debt[b]	11,191	0.522	0.244	0.000	1.000	0.334	0.721
Ratio Long Term Debt[b]	11,191	0.119	0.174	0.000	1.000	0.000	0.194
Ratio Short Term Bank Financing[b]	11,191	0.225	0.205	0.000	0.945	0.039	0.369

Panel B: Summary Statistics External Financing by Manufacturing Size[c]

Variable	Obs.	Avg.	Std. Dev.	Min.	Max.	Perc. 25	Perc. 75
Asset Tangibility Ratio - Large Size[a]	5,982	0.200	0.152	0.000	0.931	0.086	0.274
Asset Tangibility Ratio - Medium Size[a]	2,191	0.189	0.148	0.000	0.865	0.070	0.277
Asset Tangibility Ratio - Small Size[a]	3,017	0.213	0.171	0.000	0.916	0.077	0.306
Leverage Ratio - Large Size[a]	5,982	0.459	0.226	0.006	3.867	0.299	0.596
Leverage Ratio - Medium Size[a]	2,191	0.518	0.291	0.033	4.499	0.337	0.660
Leverage Ratio - Small Size[a]	3,018	0.547	0.283	0.015	3.878	0.380	0.672
Total Bank Financed Debt (ln) - Large Size	5,982	13.911	4.619	0.000	20.657	13.802	16.285
Total Bank Financed Debt (ln) - Medium Size	2,191	12.325	3.971	0.000	15.940	12.527	14.329
Total Bank Financed Debt (ln) - Small Size	3,018	11.283	3.873	0.000	15.503	11.323	13.341
# of Historical Financing Relations - Large Size	5,982	4.622	3.518	1.000	25.000	2.000	6.000
# of Historical Financing Relations - Medium Size	2,191	3.759	2.885	1.000	17.000	2.000	5.000
# of Historical Financing Relations - Small Size	3,018	2.868	2.165	1.000	15.000	1.000	4.000
Ratio Total Debt with Suppliers - Large Size[b]	5,982	0.270	0.195	0.000	0.984	0.120	0.377
Ratio Total Debt with Suppliers - Medium Size[b]	2,191	0.291	0.190	0.000	0.965	0.148	0.398
Ratio Total Debt with Suppliers - Small Size[b]	3,018	0.297	0.203	0.000	0.997	0.144	0.420
Ratio Total Debt with Banks - Large Size[b]	5,982	0.356	0.246	0.000	0.971	0.129	0.558
Ratio Total Debt with Banks - Medium Size[b]	2,191	0.303	0.221	0.000	0.988	0.105	0.480
Ratio Total Debt with Banks - Small Size[b]	3,018	0.276	0.210	0.000	0.929	0.094	0.425

Sample: 1998 − 2006.
a Measured as a ratio to Total Assets.
b Measured as a ratio to Total Liabilities.
c A manufacturer's size is determined by the entry thresholds given by Law 590 of 2000. Small manufacturers are those who have a total level of assets lower than 15,000 times Colombia's yearly minimum wage (ymw). Medium sized manufacturers are those who have a total level of assets
between 15,001 and 30,000 times Colombia's ymw. Large sized manufacturers are those who have a total level of assets higher than 30,001 times Colombia's ymw. See Table 2 for a by year reference of the implied ymw in US dollars.

Table 3.3. Per Year Export Sample Representation

Year	% Number	% Value of
1998	3,716	6,392
1999	4,396	6,415
2000	4,161	6,681
2001	3,950	7,313
2002	3,937	7,330
2003	3,829	7,448
2004	3,511	7,506
2005	3,558	7,970
2006	3,463	7,909
Sample	3,836	7,218

Sample: 1998 − 2006. Note: Own authors' calculations made with the match of exporters and the yearly universe of exporting manufacturers reported in TED.

Table 3.4. Superintendent's Time in Office at "Superintendencia de Sociedades" 1998 – 2006

Term in Office	Super-Intendent Name
1997 - 1998	Cesar Ucros Barros
1998 - 2003	Jorge Gabino Pinzon Sanchez
2003 - 2006	Rodolfo Danies Lacouture
2006 - 2007	Francisco Nogera Rocha

Sample: 1998 − 2006. Source: "Superintendencia de Sociedades". For additional information on the terms in office of each Superintendent refer to: http://www.supersociedades.gov.co/superintendencia/Historia/Documents/revista-supersociedades-73anios.pdf.

Table 3.5. Credit Elasticity of Total Value of Exports

Dependent Variable:	**(1)**	**(2)**	**(3)**	**(4)**
Total Value of Exports in *t* (ln)	**No IV**	**IV**	**IV**	**IV**
Total Bank Financed Debt in t (ln)	.008	.051	.059	.049
	(.003)**	(.023)**	(.026)**	(.023)**
Leverage Ratio in t-1	- 0.241	- 0.286	- 0.319	- 0.278
	(0.199)	(0.202)	(0.227)	(0.198)
Inverse Mills Ratio				0.583
				(0.611)
Observations	11.191	11.191	11.191	11.191
R2	0.887	0.882	0.910	0.883
First Stage: Credit Supply in t		0.743	0.682	0.743
First Stage: F-statistic		46.294	30.415	47.136
Test Instruments Selection Equation				800.798
P-value				0.000
Manufacturer Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	No	Yes
Sector-Year Fixed Effects	No	No	Yes	No

Sample: 1998−2006. Number of exporters: 2,930. We only include manufacturers within economic sectors of Agriculture (1−5) and Manufacturing (15 − 39) as defined by the international standard industry classification, ISIC revision 3.1 at the 4 digit level.
Source: Authors' own calculations. Notes: New Bank Financing in *t* (ln) corresponds to the logarithm of the new bank financing obtained in *t*. Columns (2), (3) and (4) instrument a manufacturer's demand for bank credit with the total bank supply of banking credit net of a manufacturer's own credit supply. Column (4) includes a control for the sample selection bias of SS's database. Instruments for entry into the SS's database are obtained from the terms in office reported in Table 4. All specifications cluster standard errors by industry classification *, ** and *** means significant at 1%, 5% and 10% respectively.

Table 3.6. Credit Elasticity of Market Reach

Dependent Variable:	**(1)**	**(2)**	**(3)**	**(4)**
Total Market Reach in *t* (ln)*a*	**No IV**	**IV**	**IV**	**IV**
Total Bank Financed Debt in t (ln)	0.002	0.024	0.027	0.023
	(.001)	(.007)***	(.008)***	(.007)***
Leverage Ratio in t-1	- 0.066	- 0.090	- 0.102	- 0.085
	(.081)	(.082)	(.095)	(.082)
Inverse Mills Ratio				0.369
				(.294)
Observations.	11.191	11.191	11.191	11.191
R2	0.871	0.862	0.890	0.863
First Stage: Credit Supply in t		0.743	0.682	0.743
First Stage: F-statistic		46.294	30.415	47.136
Test Instruments Selection Equation				800.798
P-value				0.000
Manufacturer Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	No	Yes
Sector-Year Fixed Effects	No	No	Yes	No

a Market Reach is the measured as the ln of the head count of export market destinations. Sample: 1998 − 2006. Number of exporters: 2, 930. We only include manufacturers within economic sectors of Agriculture (1 − 5) and Manufacturing (15 − 39) as defined by the international standard industry classification, ISIC revision 3.1 at the 4 digit level. Source: Authors own calculations. Notes: New Bank Financing in *t* (ln) corresponds to the logarithm of the new bank financing obtained in *t*. Columns (2), (3) and (4) instrument a manufacturer's demand for bank credit with the total bank supply of banking credit net of a manufacturer's own credit supply. Column (4) includes a control for the sample selection bias of SS's database. Instruments for entry into the SS's database are obtained from the terms in office reported in Table 4. All specifications cluster standard errors by industry classification *, ** and *** means significant at 1%, 5% and 10% respectively.

Table 3.7. Credit Elasticity of Market Penetration

Dependent Variable:	**(1)**	**(2)**	**(3)**	**(4)**
Market Penetration in *t* (ln)*a*	**No IV**	**IV**	**IV**	**IV**
Total Bank Financed Debt in t (ln)	0.006	0.027	0.032	0.026
	(.003)**	(.020)	(.024)	(.020)
Leverage Ratio in t-1	-0.174	-0.196	-0.217	-0.193
	(.164)	(.166)	(.186)	(.164)
Inverse Mills Ratio				0.214
				(0.509)
Observations	11191	11191	11191	11191
R2	0.85	0.848	0.884	0.848
First Stage: Credit Supply in t		0.743	0.682	0.743
First Stage: F-statistic		46.294	30.415	47.136
Test Instruments Selection Equation				800.798
P-value				0.000
Manufacturer Fixed Effects	**Yes**	**Yes**	**Yes**	**Yes**
Year Fixed Effects	**Yes**	**Yes**	**No**	**Yes**
Sector-Year Fixed Effects	**No**	**No**	**Yes**	**No**

a Market Penetration is measured as the ln of a manufacturer's exports per destination. Sample: 1998−2006. Number of exporters: 2,930. We only include manufacturers within economic sectors of Agriculture (1−5) and Manufacturing (15−39) as defined by the international standard industry classification, ISIC revision 3.1 at the 4 digit level. Source: Authors' own calculations. Notes: New Bank Financing in *t* (ln) corresponds to the logarithm of the new bank financing obtained in *t*. Columns (2), (3) and (4) instrument a manufacturer's demand for bank credit with the total bank supply of banking credit net of a manufacturer's own credit supply. Column (4) includes a control for the sample selection bias of SS's database. Instruments for entry into the SS's database are obtained from the terms in office reported in Table 4. All specifications cluster standard errors by industry classification. *,** and *** means significant at 1%, 5% and 10% respectively.

Table 3.8: Credit Elasticity of Product Mix

Panel A: Product Mix at 6 digits HS

Dependent Variable: Product Mix in t (ln)[a]	**(1)**	**(2)**	**(3)**	**(4)**
Total Bank Financed Debt in t (ln)	.004 (.002)**	.018 (.010)*	.016 (.010)	.018 (.010)*
Leverage Ratio in t-1	-.090 (.081)	-.105 (.085)	-.107 (.092)	-.104 (.085)
Inverse Mills Ratio				.080 (.284)
Observations	11,191	11,191	11,191	11,191
R^2	.838	.835	.874	.835
First Stage: Credit Supply in t		.743	.682	.743
First Stage: F-statistic		46.294	30.415	47.136
Test Instruments Selection Equation				800.798
P-value				0.000

Panel B: Product Mix at 8 digits HS

Dependent Variable: Product Mix in t (ln)[a]	**(1)**	**(2)**	**(3)**	**(4)**
Total Bank Financed Debt in t (ln)	.005 (.002)***	.019 (.010)*	.016 (.010)	.019 (.010)*
Leverage Ratio in t-1	-.066 (.088)	-.082 (.092)	-.089 (.098)	-.081 (.091)
Inverse Mills Ratio				.052 (.284)
Observations	11,191	11,191	11,191	11,191
R^2	.83	.827	.868	.827
First Stage: Credit Supply in t		.743	.682	.743
First Stage: F-statistic		46.294	30.415	47.136
Test Instruments Selection Equation				800.798
P-value				0.000

Panel C: Product Mix at 10 digits HS

Dependent Variable: Product Mix in t (ln)[a]	**(1)**	**(2)**	**(3)**	**(4)**
Total Bank Financed Debt in t (ln)	.005 (.002)***	.020 (.010)**	.015 (.010)	.020 (.010)**
Leverage Ratio in t-1	-.059 (.091)	-.075 (.095)	-.083 (.100)	-.074 (.094)
Inverse Mills Ratio				.126 (.280)
Observations	11,191	11,191	11,191	11,191
R^2	.828	.825	.867	.825
First Stage: Credit Supply in t		.743	.682	.743
First Stage: F-statistic		46.294	30.415	47.136
Test Instruments Selection Equation				800.798
P-value				0.000
Manufacturer Fixed Effect	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	No	Yes
Sector-Year Fixed Effect	No	No	Yes	No

a Product Mix is measured as the ln of the head count of products exported, given the corresponding hs category. Sample: 1998 − 2006. Source: Authors' own calculations. Notes: All specifications cluster standard errors by industry classification. *,** and *** means significant at 1%, 5% and 10% respectively.

Table 3.9: Credit Elasticity of Total Value of Exports by Size[a]

Dependent Variable:	Manufacturer Size			Manufacturer Size		
Total Value of Exports in t (ln)	(1)	(2)	(3)	(4)	(5)	(6)
	Small	Medium	Large	Small	Medium	Large
Total Bank Financed Debt in t (ln)*e*	.080	.100	.024	.084	.098	.024
	(.042)*	(.029)***	(.033)	(.043)*	(.029)***	(.033)
Leverage Ratio in t-1	-.727	-.467	.122	-.768	-.420	.128
	(.439)*	(.324)	(.251)	(.428)*	(.320)	(.255)
Inverse Mills Ratio				-.181	1.012	1.373
				(.681)	(3.517	(3.838)
Observations.	3,018	2,191	5,982	3,018	2,191	5,982
R2	.872	.836	.868	.87	.837	.868
First Stage: Credit Supply in t	.693	.885	.665	.677	.884	.665
First Stage: F-statistic	14.285	23.276	25.421	13.452	23.024	25.235
Test Instruments Selection Equation				895.122	37.246	12.391
P-value				0.000	0.000	.004
Manufacturer Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

a A manufacturer's size is determined by the entry thresholds given by Law 590 of 2000 described in detailed in Table 2. Number of exporters: 2, 930 distributed as follows: 5, 982 Large, 2, 191 Medium and 3, 018 Small. The database only includes manufacturers classified within economic sectors of Agriculture (1 − 5) and Manufacturing (15 − 39) as defined by the international standard industry classification, ISIC revision 3.1. Source: Authors' own calculations. Notes: New Bank Financing in *t* (ln) corresponds to the logarithm of the new bank financing obtained in *t*. Columns (2), (3) and (4) instrument a manufacturer's demand for bank credit with the total bank supply of banking credit net of a manufacturer's own credit supply. Column (4) includes a control for the simple selection bias of SS's database. Instruments for entry into the SS's database are obtained from the terms in office reported in Table 4. All specifications cluster standard errors by industry classification. ***, ** and * means significant at 1%, 5% and 10% respectively.

Table 3.10: Credit Elasticity of Market Reach by Size[a]

Dependent Variable:	Manufacturer Size			Manufacturer Size		
Market Reach in t (ln)*a*	(1)	(2)	(3)	(4)	(5)	(6)
	Small	Medium	Large	Small	Medium	Large
Total Bank Financed Debt in t (ln)*f*	.001	.041	.030	.002	.040	.030
	(.017)	(.016)**	(.011)***	(.018)	(.016)**	(.011)***
Leverage Ratio in t-1	-.181	-.080	-.058	-.192	-.058	-.052
	(.148)	(.175)	(.117)	(.151)	(.177)	(.121)
Inverse Mills Ratio				-.162	1.719	1.626
				(.264)	(0.964)	(1.247)
Observations	3,018	2,191	5,982	3,018	2,191	5,982
R2	.848	.811	.853	.848	.812	.853
First Stage: Credit Supply in t	.693	.885	.665	.677	.884	.665
First Stage: F-statistic	14.285	23.276	25.421	13.452	23.024	25.235
Test Instruments Selection Equation				1018.406	13.901	10.222
P-value				0.000	0.000	.01
Manufacturer Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

a A manufacturer's size is determined by the entry thresholds given by Law 590 of 2000 described in detailed in Table 2. Number of exporters: 2, 930 distributed as follows: 5, 982 Large, 2, 191 Medium and 3, 018 Small. The database only includes manufacturers classified within economic sectors of Agriculture (1 − 5) and Manufacturing (15 − 39) as defined by the international standard industry classification, ISIC revision 3.1. Source: Authors' own calculations. Notes: New Bank Financing in *t* (ln) corresponds to the logarithm of the new bank financing obtained in *t*. Columns (2), (3) and (4) instrument a manufacturer's demand for bank credit with the total bank supply of banking credit net of a manufacturer's own credit supply. Column (4) includes a control for the simple selection bias of SS's database. Instruments for entry into the SS's database are obtained from the terms in office reported in Table 4. All specifications cluster standard errors by industry classification. ***, ** and * means significant at 1%, 5% and 10% respectively.

Table 3.11: Credit Elasticity of Market Penetration by Size[a]

Dependent Variable:	Manufacturer Size			Manufacturer Size		
Market Penetration in t (ln)	(1) Small	(2) Medium	(3) Large	(4) Small	(5) Medium	(6) Large
Total Bank Financed Debt in t (ln)*f*	0.079	0.059	- 0.006	0.082	0.058	- 0.006
	(.035)**	(.027)**	(0.026)	(.037)**	(.026)**	(.026)
Leverage Ratio in t-1	- 0.547	- 0.387	0.180	- 0.576	- 0.362	0.180
	(.335)	(.200)*	(.191)	(.321)*	(.201)*	(.192)
Inverse Mills Ratio				- 0.364	1.794	0.007
				(0.511)	(0.841)	(2.601)
Observations	3,018	2,191	5,982	3,018	2,191	5,982
R2	0.846	0.798	0.825	0.844	0.799	0.825
First Stage: Credit Supply in t	0.693	0.885	0.665	0.677	0.884	0.665
First Stage: F-statistic	14.285	23,276	25,421	13,452	23,024	25,235
Test Instruments Selection Equation				235.747	12.672	10.744
P-value				0.000	0.000	0.009
Manufacturer Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

a A manufacturer's size is determined by the entry thresholds given by Law 590 of 2000 described in detailed in Table 2. Number of exporters: 2, 930 distributed as follows: 5, 982 Large, 2, 191 Medium and 3, 018 Small. The database only includes manufacturers classified within economic sectors of Agriculture (1 − 5) and Manufacturing (15 − 39) as defined by the international standard industry classification, ISIC revision 3.1. Source: Authors' own calculations. Notes: New Bank Financing in *t* (ln) corresponds to the logarithm of the new bank financing obtained in *t*. Columns (2), (3) and (4) instrument a manufacturer's demand for bank credit with the total bank supply of banking credit net of a manufacturer's own credit supply. Column (4) includes a control for the sample selection bias of SS's database. Instruments for entry into the SS's database are obtained from the terms in office reported in Table 4. All specifications cluster standard errors by industry classification. ***, ** and * means significant at 1%, 5% and 10% respectively

Table 3.12: Credit Elasticity of Product Mix by Size[a]

Panel A. Product Mix - 6 digits HS						
Dependent Variable:	**Manufacturer Size**			**Manufacturer Size**		
Product Mix in t (ln)	**(1) Small**	**(2) Medium**	**(3) Large**	**(4) Small**	**(5) Medium**	**(6) Large**
Total Bank Financed Debt in t (ln)*f*	0.035	0.036	0.011	0.037	0.036	0.011
	(.023)	(.014)**	(.014)	(.024)	(.015)**	-0.014
Leverage Ratio in t-1	-0.141	-0.138	-0.020	-0.157	-0.137	-0.014
	(.124)	(.104)	(.175)	(.127)	(.106)	(.179)
Inverse Mills Ratio				-0.050	0.033	1.065
				(0.158)	(1.920)	(1.789)
Observations	3,018	2,191	5,982	3,018	2,191	5,982
R2	0.842	0.778	0.821	0.840	0.778	0.821
First Stage: Credit Supply in t	0.693	0.885	0.665	0.677	0.884	0.665
First Stage: F-statistic	14.285	23.276	25.421	13.452	23.024	25.235
Test Instruments Selection Equation				919.253	27.921	19.687
P-value				0.000	0.000	0.007
Panel B. Product Mix - 8 digits HS						
Dependent Variable:	**Manufacturer Sizeb**			**Manufacturer Sizeb**		
Product Mix in t (ln)	**(1) Small**	**(2) Medium**	**(3) Large**	**(4) Small**	**(5) Medium**	**(6) Large**
Total Bank Financed Debt in t (ln)*f*	0.038	0.037	0.011	0.039	0.037	0.011
	(.022)*	(.015)**	(.014)	(.024)*	(.015)**	(.014)
Leverage Ratio in t-1	-0.118	-0.085	-0.012	-0.132	-0.080	-0.007
	(.129)	(.127)	(.177)	(.130)	(.126)	(.180)
Inverse Mills Ratio				-0.228	0.306	0.898
				(0.223)	(1.491)	(1.717)
Observations	3,018	2,191	5,982	3,018	2,191	5,982
R2	0.831	0.759	0.817	0.829	0.759	0.817
First Stage: Credit Supply in t	0.693	0.885	0.665	0.677	0.884	0.665
First Stage: F-statistic	14.285	23.276	25.421	13.452	23.024	25.235
Test Instruments Selection Equation				481.048	30.613	12.609
P-value				0.000	0.000	0.005
Panel C. Product Mix - 10 digits HS						
Dependent Variable:	**Manufacturer Sizeb**			**Manufacturer Sizeb**		
Product Mix in t (ln)	**(1) Small**	**(2) Medium**	**(3) Large**	**(4) Small**	**(5) Medium**	**(6) Large**
Total Bank Financed Debt in t (ln)*f*	0.039	0.037	0.012	0.040	0.037	0.012
	(.023)*	(.015)**	(.015)	(.024)*	(.015)**	(.014)
Leverage Ratio in t-1	-0.082	-0.074	-0.021	-0.089	-0.067	-0.016
	(.151)	(.134)	(.175)	(.153)	(.134)	(.178)
Inverse Mills Ratio				-0.032	0.389	1.309
				(0.164)	(0.661)	(0.661)
Observations	3,018	2,191	5,982	3,018	2,191	5,982
R2	0.828	0.757	0.816	0.828	0.757	0.816
First Stage: Credit Supply in t	0.693	0.885	0.665	0.677	0.884	0.665
First Stage: F-statistic	14.285	23.276	25.421	13.452	23.024	25.235
Test Instruments Selection Equation				880.126	19.438	11.805
P-value				0.000	0.000	0.000
Manufacturer Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

a Product Mix is measured as the ln of the head count of products exported, given the corresponding hs category. Sample: 1998 − 2006. Source: Authors own calculations. Notes: All specifications cluster standard errors by industry classification. ***, ** and * means significant at 1%, 5% and 10% respectively.

Table 3.13: Credit Elasticity of Product Mix and Country Destination

Panel A. Product Mix - 6 digits HS		
Dependent Variable:	**(1)**	**(2)**
Product Mix in t (ln)a	**No IV**	**IV**
Total Bank Financed Debt in t (ln)	0.002	0.363
	(0.014)	(0.123)***
Leverage Ratio in t-1	-0.097	-0.628
	(0.230)	(0.239)***
Observations	189,118	189,118
R2	0.894	0.891
First Stage: Credit Supply in t		0.118
F-stat First Stage		52.03
APF First Stage		52.03
APFCHI2 First Stage		53.00
Panel B. Product Mix - 10 digits HS		
Dependent Variable:	**(1)**	**(2)**
Product Mix in t (ln)a	**No IV**	**IV**
Total Bank Financed Debt in t (ln)	0.001	0.286
	(0.014)	(0.120)**
Leverage Ratio in t-1	-0.152	-0.565
	(0.233)	(0.238)**
Observations	202,092	202,092
R-squared	0.894	0.892
First Stage: Credit Supply in t	0.124	0.105
F-stat First Stage	91.35	36.86
APF First Stage	91.35	36.86
APFCHI2 First Stage	93.17	37.51
Firm Fixed Effect	Yes	Yes
Municipality-Sector-Country-Year	Yes	Yes

a Product Mix is measured as the ln of the head count of products exported, given the corresponding hs category. Sample: 1998 − 2006. Source: Authors' own calculations. Notes: All specifications cluster standard errors by industry classification. *,** and *** means significant at 1%, 5% and 10% respectively.

Table 3.14: Credit Elasticity of Product Mix and Country Destination – Robustness Check

Panel A. Product Mix - 6 digits HS				
Dependent Variable: Product Mix in t (ln)a	**(1)**	**(2)**	**(3)**	**(4)**
Total Bank Financed Debt in t (ln)	0.363	0.363	0.363	0.363
	(0.088)***	(0.121)***	(0.086)***	(0.123)***
Leverage Ratio in t-1	-0.628	-0.628	-0.628	-0.628
	(0.202)***	(0.225)***	(0.185)***	(0.239)***
Observations	189,118	189,118	189,118	189,118
R-squared	0.891	0.891	0.891	0.891
First Stage Credit Supply l_tcred	0.118	0.118	0.118	0.118
F-stat First Stage	99.01	83.67	348.8	52.03
APF First Stage	99.01	83.67	348.8	52.03
APFCHI2 First Stage	100.4	85.22	353.5	53.00
Panel B. Product Mix - 10 digits HS				
Dependent Variable: Product Mix in t (ln)a	**(1)**	**(2)**	**(3)**	**(4)**
Total Bank Financed Debt in t (ln)	0.286	0.286	0.286	0.286
	(0.099)***	(0.117)**	(0.096)***	(0.120)**
Leverage Ratio in t-1	-0.565	-0.565	-0.565	-0.565
	(0.210)***	(0.223)**	(0.194)***	(0.238)**
Observations	202,092	202,092	202,092	202,092
R-squared	0.892	0.892	0.892	0.892
First Stage Credit Supply l_tcred	0.105	0.105	0.105	0.105
F-stat First Stage	65.75	64.87	281.6	36.86
APF First Stage	65.75	64.87	281.6	36.86
APFCHI2 First Stage	66.59	66.01	285.2	37.51
Firm Fixed Effect	Yes	Yes	Yes	Yes
Municipality-Sector-Country-Year	Yes	Yes	Yes	Yes

a Product Mix is measured as the ln of the head count of products exported, given the corresponding hs category. Sample: 1998 − 2006. Source: Authors' own calculations. Notes: All specifications cluster standard errors by industry classification. *,** and *** means significant at 1%, 5% and 10% respectively.

Table 3.15: Credit Elasticity - Country Destination with Rauch classification

Panel A. Product Mix - 6 digits HS				
Dependent Variable: Product Mix in t (ln)a	**(1)**	**(2)**	**(3)**	**(4)**
Total Bank Financed Debt in t (ln)	0.394	0.353	0.377	-0.209
	(0.345)	(0.127)***	(0.133)***	(0.595)
Leverage Ratio in t-1	-1.653	-0.540	-0.479	0.007
	(2.361)	(0.257)**	(0.269)*	(1.567)
Observations	7,501	180,968	152,505	28,463
R-squared	0.952	0.887	0.875	0.962
First Stage Credit Supply l_tcred	0.188	0.115	0.122	0.0263
F-stat First Stage	6.205	53.35	64.07	0.941
APF First Stage	6.205	53.35	64.07	0.941
APFCHI2 First Stage	6.766	54.35	65.39	0.982
Panel B. Product Mix - 10 digits HS				
Dependent Variable: Product Mix in t (ln)a	**(1)**	**(2)**	**(3)**	**(4)**
Total Bank Financed Debt in t (ln)	0.257	0.277	0.313	-11.044
	(0.239)	(0.123)**	(0.133)**	(76.138)
Leverage Ratio in t-1	-1.524	-0.448	-0.366	32.615
	(1.596)	(0.248)*	(0.264)	(234.151)
Observations	8,626	192,813	163,045	29,768
R-squared	0.955	0.888	0.875	0.102
First Stage Credit Supply l_tcred	0.211	0.103	0.110	0.00334
F-stat First Stage	6.540	36.73	43.14	0.0197
APF First Stage	6.540	36.73	43.14	0.0197
APFCHI2 First Stage	7.056	37.39	43.98	0.0205
Firm Fixed Effect	Yes	Yes	Yes	Yes
Municipality-Sector-Country-Year	Yes	Yes	Yes	Yes

a Product Mix is measured as the ln of the head count of products exported, given the corresponding hs category. Sample: 1998 − 2006. Source: Authors' own calculations. Notes: All specifications cluster standard errors by industry classification. *,** and *** means significant at 1%, 5% and 10% respectively.

Chapter 4

Geographical Credit Markets, Distance and Asymmetric Information: Evidence for Colombia

4.1 Introduction

Local financial development and the increase in the outreach of the provision of financial services are two relevant engines of growth and poverty reduction (Burgess and Pande, 2005; Beck, Demirgüç-Kunt and Levine, 2007; Levine, 2008; Demirgüç-Kunt, Beck and Honohan, 2008; Arestis and Caner, 2009; Bittencourt, 2010). Financial development, especially in developing economies, has been pursued through commercialization of bank services and through an intense process of liberalization and globalization of banking (Hanson, 2003; Cull and Martinez Peria, 2010).

The idea is that businesses obtain necessary funds from banks and implement the optimal level of investment. Nevertheless, imperfections in the market restrict access to loans and limited the impact of credit. Explanations emerge from the costs of monitoring and ex-post moral hazard fueled by information asymmetries. Indeed, the amount granted and the terms applied to a loan depend on the financial position and credit history of the borrower as well as on the potential success of the proposed entrepreneurial projects. This body of information determines the lending decisions in that it reduces asymmetry between lenders and borrowers. Relationships, then are conditioned by how markets collect, process, and transmit such information.

Finding ways to analyze these frictions is crucial as lenders typically cannot rely on risk-mitigation techniques such as collateral (Bester, 1987) or contingency contracts (Bolton and Scharfstein, 1990). Due to credit-market imperfections, some creditworthy borrowers continue to be credit rationed while at the same time others take on too much debt. These credit imperfections have received attention to access to credit but little is known about how those affect firms decisions.

In this paper we use distance as proxy for transportation costs and informational asymmetries between borrowers and lenders. Short distance is associated with a competitive advantage in terms of less costly searching and monitoring and, as an instrument to spatially discriminate prices (Calem and Nakamura, 1998; Degryse and Ongena, 2005).

Distance can also discipline borrowers, for example business located at greater distances must maintain an unimpeachable credit performance[38]. This means that the effect of distance should be heterogeneous on firms. Small- and medium- sized firms are more credit constrained than big firms are due to their opaque structures and fewer legal representatives. Additionally, to serve small and medium-sized enterprises, banks have set up dedicated departments and decentralized the sale of products to branches; however, loan approval, risk management, and loan recovery functions still remain centralized. Consequently, banks are less exposed to small enterprises and, in effect, charge higher interest and experience poor performance of loans (Beck, Demirgurc-Kunt, Martinez, 2008).

While a number of recent studies have examined distance's role as a lending barrier, adequate empirical evidence is lacking on how distance shapes the geographical scope of the supply and demand of credit. "A market for a good is the area within which the price of a good tends to uniformity, allowance being made for transportation costs" (Alfred Marshall in Stigler and Sherwin, 1985). Determining geographic credit boundaries will further the discussion of firm performance and capital structure requirements for lending businesses and local financial development.[39]

Defining markets at the local rather than cross-local level carries two policy implications. First, if firms are constrained at the local level, then economic fluctuations will continue longer as they will be amplified by the demise of local financial institutions and by the inability of outside institutions to step in as substitutes (Petersen and Rajan, 2002). This implies that regulators must be responsive to local

[38] Two reasons emerge shared information among lenders (Hertzberg, Liberti and Paravisini; 2011, González-Uribe and Osorio, 2014; Bos, De Haas and Millone, 2015) and restrictions of outside options (Presbitero and Rabelloti, 2011)

[39] Besides prices and quantities, Chiappori, Perez-Castrillo, and Verdier (1995) have considered location as a strategy for banks, arguing that market definition enhances the importance of branch network as a competitive asset.

shocks. The second implication concerns regulatory policies in two senses. In the first sense, mergers and acquisitions regulations defined at the geographic level may not reflect the true size of a market, which may mislead authorities in determining which mergers to permit or avoid. In the second sense, a relevant market definition broadens our understanding of the causes of consolidation and allows us to see such causes as not only a factor for the evaluating the consequences of competition, efficiency and stability in the banking sector (Novo-Peteiro, 2009).

Literature has documented geographical distance as proxy for transportation costs and informational asymmetries between borrowers and lenders (Petersen and Rajan, 2002; Alessandrini, Fratianni, and Zazzaro 2006). Short distance is associated with a competitive advantage in terms of less costly searching and monitoring and, as an instrument to spatially discriminate prices (Calem and Nakamura, 1998; Degryse and Ongena, 2005).

This chapter aims to define geographical markets through a combination of a cluster methodology and a market segmentation model. The results are first used to determine the position of a city in the credit network and then are used to evaluate the role of distance and local financial development on firms' decisions in the following ways. First, as transaction costs focusing on the cost of delivering the financial service to the borrower. Second, as monitoring cost to assess whether the lender needs to collect pre-loan approval information on the borrower (adverse selection), or monitor the borrower after the loan is made (moral hazard).

The novelty of this study is twofold: it applies a non-standard method to define geographical market and evaluates its impact on firm performance. Diamond (1991), Rajan (1992), Hart and Moore (1995), Bolton and Scharfstein (1993), and Harris and Raviv (1990) note that firms' optimal choices depend on the information available to investors and on the ability of investors to monitor firms and enforce legal rights. Information is a binding constraint for having access to credit but, also it also impacts the performance of the loan. Cost of monitoring the borrower, may induce the lender deviate the purpose of the loan.

We use a firm-bank branch data set from Colombia between 1998 and 2006 to identify the credit relations among firms, banks, and loan characteristics at the city level. Commercial banks have a comparative advantage relative to other financial institutions when financing (Berger and Udell, 2006; Berger, Rosen and Udell, 2007). Until recently, considerable literature argues that small banks are more prone to finance SMEs because of their being better suited to relationship lending, a type of financing based primarily on soft information gathered by the loan officer through continuous, personalized, and direct contact with SMEs, their owners and managers, and the local communities, which mitigates transparency problems (Berger, Kashyap, and Scalise, 1995; Keeton, 1995; Strahan and Weston, 1996). Focusing on the variations between small and large firms, our dataset allows us to measure the impact of geographical market on capital structure requirements and loan performance by firm size.

We find high costs tightens lending at the intensive and extensive margin, with proximity between cities affecting up to a scale of 5 km. Our findings also support recent observations about the use of cash as the principle means for electronic transactions in Colombia (i.e. 90 percent of transactions are made with cash (CCIT and FEDESAROLLO, 2015) At firm level, we find that this relationship is stronger for smaller firms and reflects in a poor use of loan and lower debt. On the other side, distance has a positive impact on loan's performance. Results suggest that distance plays a stronger role when soft information is more valuable.

The structure of this chapter is as follows. The next Section presents an overview of the literature, followed by a discussion of market definitions according to Antitrust Authorities in Colombia, the United States, and Europe. Section 4.3 describes the data, then Section 4.4 presents the gravity model with the results. Section 4.5 exhibits the cluster and segmentation model. Section 4.6, shows the results of geographical market on firm performance. The final Section offers concluding comments and outlines our study's implications.

4.2 Literature Review

The information a firm provides plays an important role in determining the cost of capital because it allows investors to recognize the firm's value (Merton, 1987) and better estimate the firm's risks and prospects (Barry and Brown, 1985). There is a an extensive literature on credit markets showing that asymmetric information prevents the efficient allocation of lending, thus driving a wedge between lending and borrowing rates and leading to credit rationing (Stiglitz and Weiss, 1981).

Ayyagari, Demirguc-Kunt and Maksimovic (2012) have examined the differences in how large and small firms release their information. Large firms tend to employ formal and informal practices when collecting and disclosing information, while the information of small firms depends on a credit bureau's presence[40]. In the absence of these offices, small business benefits from a close proximity to banks because of the firm's opacity, higher costs stemming from a dearth of information, and the personnel required to obtain such information (Petersen and Rajan, 2002). It is difficult to collect the information of small firms because they have soft or difficult to communicate information. This requires that the lender have local presence and offer credit close to where the information is gathered. If a small lending business only has access to large banks, then they may face higher restrictions since these banks are typically headquartered at a substantial distance from potential customers, which aggravates the problems associated with transmitting soft information to senior bank management (Berger and Udell, 2002).

Soft information may allow the bank a competitive informational advantage over basing decisions primarily on public data by more precisely signaling the creditworthiness of the firm. Collecting soft information is a personal process and the verification, transmission, and storing of such information tends to be quite difficult (Stein, 2000). At large banks, information flow induces organizational diseconomies in a number of ways (Berger and Udell, 2002). The flow of information can create internal

[40] Despite most of credit bureaus were created at the 1960's (Japelli and Pagano, 2002), was only Basel II, that these offices consolidated their role in credit risk management. In Colombia, the most important bureau consolidated its tasks in 2012.

agency problems between loan officers—often considered receptacles of soft information—and their superiors. These problems stem from the intangible nature of soft information and, in particular, from the difficulty in diffusing this information within a large and complex organization. Principal-agent theory has analyzed the necessary trade-off between delegation and control. In fact, Udell (1989) and Berger and Udell (2002) have shown that the specialization in relationship lending (e.g, small business lending) should go hand in hand with more investment under loan officers' control. Doing so endows small, decentralized banks with a comparative advantage in small business lending. Considerable research has been devoted to testing empirically the relation between banks' organizational structures and credit availability to small firms. Numerous studies have demonstrated that the organizational complexity of a bank reduces the availability of credit to small businesses (Berger et al., 1999). Small firms are highly dependent on bank financing (Berger and Udell, 1998), and this dependency is compounded by the fact that large banks allocate fewer resources to small business lending than small banks, a reluctance which originates in the competitive disadvantage of larger institutions to evaluate a prospective firm's creditworthiness (Berger and Udell, 1996; Keeton, 1995; De Young et al., 1999; Alessandrini et al., 2008; Sapienza, 2002). Jayaratne and Wolken (1999) have produced contrary evidence suggesting the absence of a cost advantage for small banks in offering credit to small borrowers.

A necessary closeness to borrowers can be a source of inefficiency for banks because it increases the costs of maintaining large-scale, geographically distanced lending operations with strong diseconomies of scale in lending to small businesses (Degryse and Ongena 2004).[41] Inefficiency then leads to market imperfections. For given physical locations of borrower and lender, distance creates an imbalance in the competitive environment of the credit market. Distance shifts market power toward the

[41] Operational Distance is the physical gap created by the distance between the borrower and the bank. Functional distance is the economic distance from a region of a bank which, even if physically close to local customers through its operational structures, has its decisional centres and strategic functions located far from customers (Alessandrini, Presbitero and Zazzaro, 2006).

bank located closest to the firm. In turn, banks located farther away are at a competitive disadvantage as they require greater efforts to establish a credit relation (Cerqueiro, Degryse and Ongena, 2009). Park and Pennacchi (2009) have pointed out that small banks operate in one local market while large banks operate in multiple markets. A small bank sets retail loans and deposit interest rates based on the competitive conditions. However, a large bank chooses retail rates that are uniform across markets and that reflect its differential operating, funding costs, and competitive conditions in multiple markets. This line of research shows that retail loans and deposit rates set by banks depend on the market's concentration and distribution of large and small banks. Thus, the merging and centralization of bank operations creates legitimate concerns over credit falling off (Berger et al., 1998; Strahan and Weston, 1998; Berger and DeYoung, 2000).

Because banks are significant transaction- and information-intensive lenders, they need easy access to borrowers' information, which necessitates being close to transparent clients. The easy access to phone and mail, the improvements in storing borrowers' information, and the existence of infomediaries as credit bureaus should facilitate information flow and make the location of banks irrelevant. Still, despite these advances, banks continue opening branches in the same cities (Figure 3 (a)) which happen to be the cities with highest economic performance (Figure 3 (b)) and financial depth (Table 16). This trend highlights how distance is a cost indicator not only in credit allocation but in other aspects as well. That banks open multiple branches within a city also supports evidence that small businesses continue to use local banks, a choice that makes these businesses sensitive to local economic shocks that can persist for a long time due to the amplification effected by incumbent institutions and by outside institutions' inability to step in (Petersen and Rajan, 2002).[42]

In local financial markets, information is a source of market power in three ways: 1) ex-ante by the proximity to lending firms which facilitates advertising and the collection of information; 2) ex-post by the information firms obtain during the lending relationship which involves market and firm

[42] As Brevoortsi and Wolken (2009) have noted, changes over time might not always be monotonic.

performance (Degryse and Ongena, 2005; Carling and Lundberg 2005) and the costs associated with maintaining relationships with former customers or agents that interact with potential customers; and 3) the time in between. As distance increases, so too does a firm's search cost when it seeks to find alternative lenders with the ability to deal with specific needs in a local market with few lenders (Petersen and Rajan, 1995). These search costs may vary with the distance between the customer and financial institutions and with the degree of heterogeneity in financial services (Brevoort and Wolken 2009). Thus, the degree of information asymmetry due to the costless (but still imperfect) information is lower the greater proximity to the bank.

Because of the undeniable relationship between distance and information, others (Elliehausen and Wolken, 1997; Degryse and Ongena, 2005; Brevoort and Wolken, 2009) argue that the study of location can illuminate the consequences of monopolistic competition in the banking sector and that location may be an important factor in the provision of financial services given market transaction costs.[43] Chiappori, Perez-Castrillo, and Verdier (1995) develop a spatial competition model for the banking sector in which location is endogenous. These models commonly predict that while firms may incur different transportation costs, banks resort to pool pricing as they do not account for the location of borrowers. However, if banks know applicants' addresses, they can engage in spatial price discrimination based on the physical distance separating them from the firm. Greater distances and hence larger transportation costs result in stronger local monopoly power for the bank. Accordingly, a bank optimally charges higher loan rates to those borrowers located closest to its branch. Monopoly power is defined in this setting for given locations of potential competitors. The rationale is that closer borrowers face higher transportation costs when visiting competing banks located farther away than the initial lending bank. This scenario enables the lending bank to increase loan rates by an amount equivalent, in the limiting case, to the opportunity transportation cost faced by the borrower. Degryse and Ongena

[43] This is especially true for those related with credit risk (i.e. supplying funds dependent on the quality of borrowers).

(2005) find that loan rates decrease with the distance between a firm and its lending bank and then increase with distance between a firm and competing lenders. These researchers identify banking competition and pricing strategies by including both the number of bank branches and the distance between the borrower and nearby competing bank branches.[44] In addition, Degryse and Ongena find that transportation costs—not informational asymmetries—are probably the main basis for the spatial price discrimination. However, monitoring costs sets other sources of price discrimination. Sussman and Zeira (1995) argue that the reason banks can extract rents from closer borrowers is that more distant competing banks include in the loan rate the cost of high monitoring.

Alessandrini, Croci, and Zazzaro (2009) contribute the notion of functional distance to market structure analysis. They argued that functional distance may be particularly critical in riskier[45] and less developed cities because the isolation from strategic banking functions requires a more qualified staff.

Basing their study on the rule that asymmetries of information intensify with distance, Hauswald and Marquez (2006) argue that banks can use their informational advantage strategically to create a threat of adverse selection for rivals and thus soften competition. As a result, the informed lender can charge higher loan rates to closer firms, but distance discourages the lender from investing in informational activities. Consequently, distance weakens the bank's capability to extract rents from borrowers and aggravates adverse selection problems for the lender.

Examining consumers' perspectives, Ho and Ishii (2011) propose a model of consumer demand for retail banks in which consumers choose a single bank as a depository. In such a situation, consumer welfare is positively related with number of branches. The researchers, however, note that if new branches cluster in particular neighborhoods, then the welfare increase may be smaller than if branches had been spaced equally throughout the market. Indeed, consumers significantly prefer banks that are

[44] They relate this fact with branch concentration.

[45] Risky cities are defined based on bank performance indicators (i.e. portfolio allocation, screening ability, cost and revenue efficiency) and loan characteristics (i.e. lending dynamism, rate conditions) and institutional differences.

active in a large number of markets and those that have been active for a long time. Such institutions tend to have a positive utility from high deposit interest rates and a negative utility from travel. Ho and Ishii also find that consumers significantly prefer banks where the majority of branches are located in the consumer's home market.

Keeping in mind that local financial market matters, the definition of local requires attention. Petersen and Rajan (2002) argue that the most effective size of credit markets for small firms is continuously expanding as a result of changes in technology. Their rationale is that if lenders have to be local, then the concentration of lenders in a nearby geographic area is where antitrust authorities should focus when making decisions regarding mergers. Consequently, the relevant size of the market that policy makers should regulate comes into question.

This study connects with the relatively scarce literature on financial agglomeration. In the traditional treatment of externality, agglomeration occurs within a region because of knowledge spillovers that are limited in geography (Head, Ries, and Swenson; 1995). In our case, the spillover knowledge concerns loan granting capacity to a specific city. Intuitively, the higher number of banks relates to higher competition, and this then translates into lower loan rates because it reduces distance between firms and neighboring banks. Some studies, however, have found that an increase in the number of banks aggravates the adverse selection problem by enabling low-quality firms to obtain financing (Broecker, 1990). An increase in the number of banks may also result in a reduction of loans (Hauswald and Marquez, 2006), which in turn leads to higher loan rates. Bourgain and Pieretti (2006) studied the technological and pecuniary externalities of the Luxemburg banking sector. Using macro data, they find that the agglomeration of financial intermediaries drove significant expansion in business services firms. Recognizing the dependence of the financial industry on the development of local economies and on the capacity of local markets, Liang, Lin and Li (2014) demonstrate that the spatial agglomeration of Chinese financial services promoted financial knowledge spillovers.

The empirical economic evidence used to determine market size is limited despite some work that suggests statistical and intuitive differences in the way that the credit market is defined. Guiso, Sapienza and Zingales (2004) shows such statistical differences by defining local markets as provinces or regions. Despite the Italian antitrust authority's definition of market boundaries by provinces, the study used regions to define the credit market. Zardkoohi and Fraser (1998) and Pita et al. (2005) question the use of individual states to demarcate the banking market because the geographical scope depends on service type (e.g., consumer loans meet small local markets and commercial loans meet worldwide markets) and class of customer (e.g., retail banking customers, unlike, wholesale customers, are scattered spatially and have little mobility). Novo-Peteiro (2009) add that merger outcomes reflect a local or cross-local market.

4.3 Market Definition Background

The use of local geographic banking markets has been cause for controversy in recent years due to the different factors that blur the precision of measurements in the distinction between local and non-local institutions. The expansion of bank branch networks, the spread of automated teller machines, and the growth of internet banking have led some to argue that banking markets are now statewide or larger in scope.

In Colombia, the "Superintendencia de Industria y Comercio" (SIC),[46] argues that a relevant market definition must take into account an analysis of product and geographic market. From the product perspective, SIC includes demand (i.e., firms in the market, description of products, prices, sold quantities, and substitute products), supply (i.e., similar firms which are able to produce or import the product), and other criteria (i.e., secondary or related products). Relevant geographic market refers to the place where firms offer their products and find demand for them. The area must display enough similar competition conditions so as to differentiate it from neighboring areas. Additionally, SIC

[46] *Resolucion* 51694 of December 4, 2008.

specifies that a geographic market depends on vertical or horizontal integration. In the case of horizontal integrations, authorities must establish the minimum point where firms find it profitable to raise prices without modifying the prices of other products in other geographic areas. In the case of vertical integration, authorities must undertake a horizontal integration analysis in each market where firms are involved and participate in the same value chain.

Market definition has long been a controversial issue in competition and merger cases in both the United States and Europe. Authorities have focused their attention on methods of measuring market power directly which obviates the need to define markets (Massey, 2000). In general, the more narrowly authorities define a market, the more likely it is that they will find a firm or firms to have market power. Not surprising, firms tend to advocate wider market definitions than those adopted by competition authorities (Morris and Mosteller, 1991).

A relevant market definition has been tracked in the United States since the 1950s when the Supreme Court accepted cross-price elasticities of demand in their definition. A profit-maximizing monopolist will generally raise prices to the point where other products become close substitutes. Looking at the degree of product substitution at prevailing prices involves considering the market share after the firm or firms have already raised prices. Under such circumstances, cross-elasticities establish that the firm or firms lack the power to raise prices any further. In abuse of dominance cases, the market must be defined by cross-price elasticities at the competitive price rather than at the prevailing price level. Massey (2000) points out that in this case one cannot observe competitive prices but instead must infer them.

In the Philadelphia National Bank, the Court defined the relevant market as the four-county Philadelphia metropolitan area. Simons and Williams (1993) claim that this judgment appeared to do nothing more than split the difference between two extremes. Werden (1992) argues that the relevant market should not be defined based on competition or substitutability between products and areas. The Supreme Court defined markets based on existing product substitutes, but a relevant market cannot

meaningfully encompass such an indefinite range. The circle must be drawn narrowly enough to exclude any other products to which only a limited number of buyers will turn within reasonable price variations.

In the United States, the last revision of the 1997 Department of Justice's and Federal Trade Commission's Horizontal Merger Guidelines defined a market as a "product or group of products and a geographic area such that a hypothetical profit-maximizing firm, not subject to price regulation, that was the only present and future producer or seller of those products in that area likely would impose at least a 'small but significant and nontransitory' increase in price, assuming the terms of sale of all other products are held constant."[47]

When the European Court of Justice first considered the effect of market base on the role of supply substitutability it decided not to rely on cross-elasticity of demand data, opting instead for more subjective characteristics of the product under consideration. In 1986, the EU Commission stated that deciding whether products were interchangeable "must be judged from the vantage point of the user, normally taking the characteristics, price and intended use of the goods together." Kauper (1996) observes that the characteristics, price, and intended use formula appears regularly—in an almost ritualistic way—in all subsequent commission decisions.

The following are the methodologies used in market definition:

Cross-Price Elasticity

Traditionally, researchers defined markets based on the cross-price elasticity of demand, which measures the responsiveness of the change in demand for a product in relation to changes in the price of another product. This approach suffers from a number of shortcomings. It is unclear, for instance, how high the cross-price elasticity of demand needs to be before goods can be considered part of the same

[47] In Amel, Kennickell & Moore. (2008). Original quote in Department of Justice and the Federal Trade Commission, *Horizontal Merger Guidelines* www.usdoj.gov/atr/public/guidelines/horiz_book/hmg1.html

market. In abuse of dominance cases, estimating cross-price elasticities at the prevailing market price leads to wrong conclusions.

Werden (1998) argues that a small increase in the price of product A may cause sufficient consumers to switch to product *B*, thus rendering product *A* unprofitable and causing its manufacturer to impose a unilateral price increase. The reverse, however, need not be true. More importantly, Werden also notes that the inquiry into whether one product is in the same market as another need focus only on the competitive significance of individual substitutes rather than on the collective competitive significance of all substitutes.

Price Correlations

On the basis that prices of substitute products cannot diverge too greatly from one another, Shrieves (1978), Horowitz (1981), and Stigler and Sherwin (1985) suggest using price correlations to define product or geographic markets. Price correlations, though, have certain shortcomings when defining a market for competition analysis. The prices of two products will be perfectly correlated if a specified percentage change in the price of one product results in a consistent percentage change in the other. Price correlations can also yield misleading results because it is possible to have high levels of correlation even though the products are not good substitutes.

Slade (1986) points out that spurious correlations can result if mutually causal factors are not held constant. Price data may, however, show that products are in different economic markets in which case one can safely conclude that they are not substitutes.

Product Flows

Elzinga and Hogarty (1978) suggest defining geographic markets based on product flows. The researchers proposed a test based on the percentage of a product consumed in its area of production and the percentage of a product produced in the area that it is consumed. If both values are high, then the

geographic area in question should be regarded as a separate geographic market. Elzinga and Hogarty define critical values for the test without economic background (Kaserman and Zeisel, 1996).

Stigler and Sherwin (1985) show that the presence or absence of trade flows between two areas is neither a necessary nor a sufficient condition to establish the existence of a single market. It is possible to have large trade flows between two areas, but if they are distinct markets, then price discrimination may result in large and persistent price differentials that are unrelated to transport costs.

Partial Adjustment Approach

Horowitz (1981) propose a regression based approach designed to reflect the fact that equilibrium price adjustments across same market geographic areas and products may not occur instantaneously. The Horowitz model assumes that there exists some unobservable and stable long-run equilibrium price difference between areas or products where this difference is approached with a lag. Horowitz used a partial adjustment model to estimate the long-run equilibrium price difference and the speed of adjustment to that difference.

Stigler and Sherwin (1985) argue, however, that the Horowitz model has no general validity as an approach to equilibrium. Slade (1986) indicates that the model could yield erroneous results if price series are autocorrelated or if they exhibit either a trend or systematic seasonal movements. Slade further argues that the model is unnecessarily restrictive in its assumption concerning the pattern of dynamic adjustment. Furthermore, there is no reason to believe that a stable long-run price difference should exist between two areas.

The Causality Approach

Slade (1986) proposes a methodology based on the concept of causality as a means of testing the hypothesis that price movements in one geographic area or product have discernible effects on price movements in some other area or product. Kaserman and Zeisel (1996) note that causality tests are likely

to be highly sensitive to the model specification used. If important variables are excluded the test will yield biased results.

4.4 Data and Descriptive Statistics

Credit flows are obtained from two sources: "Superintendencia Financiera de Colombia" (SFC) and "Superintendencia de Sociedades" (SS). From SFC, we use the Active and Passive Operations file (OAC), and extract the location of bank *i* in city *x*. From a second file, Format 341, we gather loan value and number provided by bank *i* to firm *j* located in city *A*. From SS, the Information System and Business Report (SIREM) is used to obtain the location of firm *j*. By matching these three datasets, identification of a firm *j* located in *B* which gets a loan from bank *i* is possible. While unable to pinpoint the location of the bank from which the firm receives its loan (i.e. *A* may be different than *B*), we assume that the firm took it's the loan from the closest bank.[48] This dataset identifies the value and number of loans disbursed by city A to city B from 1998 to 2006.

Colombia has 1,123 municipalities and 32 departments. We identify the credit relation in 13% of the bilateral sample by measuring credit flows through two variables—value of disbursement (intensive margin) and total number of operations (extensive margin). Like Helpman, Melitz and Rubinstein (2008), observed credit flows are skewed in value and number (see Figure 4.1). The number of disbursements is low but the value is high. The reason for this may relate to distance; namely, if a firm is located far from a bank office, it tends to travel once for small loans rather than multiple times.

Regarding characteristics about the cities, graphs and statistics (Figure 4.2 and Table 4.1) show that credit services are not homogenous. Indeed, Bogota (the capital city) exhibits the highest flows due to the integration of financial services. Differences between Bogota (and surrounding areas) and other isolated cities extreme, especially with cities located at the south and west of the country. In our sample,

[48] The strategy is consistent with the empirical evidence presented in Petersen and Rajan (2002) and Guiso, Sapienza and Zingales (2004). If transport cost between borrower and lenders is close to zero due to technological evolution, the distance variable will not be significant in the empirical model.

the highest financial growth is seen in cities located at the north of the country (i.e. departments of Antioquia and Santander) while the financial depth indicator decreases in cities located in the south (i.e. departments of Meta and Vaupes).

Following previous studies on gravity, we use distance as the main proxy for transport costs. Two measures are included: linear distance and road distance.[49] Figure 4.3 displays the plot of the distance distribution for observation with credit relation. Most cities with a credit relation are located less than 400 km from each other (Figure 4.3(a)). One important caveat is the zero value. Distance can take value of zero for two reasons: there is no credit relationship or the borrower and lender are located in the same city. Figure 4.3 (b) shows that distance between lenders and borrowers has increased over time. This makes the bilateral observations almost as frequent as those performed inside the same city. We find a negative linear relation between credit (intensive and extensive) and distance, and high dispersion in the relation between interest rates and distance (Figure 4.4). The interest rate density is skewed toward low values (Figure 4.5).

To measure the potential supply and demand for credit we use GDP[50] in the borrower and lender cities, number of firms, and firms' size.[51] Market power is measured using the Herfindahl-Hirschman Index (HHI) by municipality, department and three radii of distance (4 km, 55 km, and 400 km). The construction of the HHI uses the OAC dataset, which involves calculating the indices by considering the total demand for commercial credit. By observing the differences in Figures 4.6 and 4.7, market power relates to the geographical extension of the market. Therefore, banks have more market power in small geographical markets than in large geographical markets.

Regarding data at the firm level, Figures 4.8 and 4.9 depict a number of variables to broaden the firm level analysis. Despite size, all firms are located less than 55 km from the banking institution. Credit

[49] Calculus of road distance was made in ARCGIS, given all the roads of Colombia are not mapped, in the estimation we include circular distance since by considering the road distance we just can have information for 308 cities with bilateral credit relation.
[50] We calculate GDP at city level following Sanchez and Nunez (2012)
[51] We calculate the median of the assets of the firms in the borrower city.

behavior, however, diverges, with small firms being granted fewer loans but perform more operations than larger firms.

Table 4.2 presents the summary statistics of selected variables of cities that have credit relations. Most borrowers do not have a bank office in the city where they operate with only 5.26 % (717 credit ties) of the operations are performed in the same city where the firm is located.

Table 4.3 presents statistics for the entire sample of firms with credit. In the sample period, 89% of the borrowers have a loan in the same city and the average borrower who does not have loan in the same city has a loan in a city located on average 5 km distant (with a dispersion of 26 km). Borrowers have credit relationships with at least 1 bank and maximum 16 banks with an average of 5 and they perform on average 1 operation. The length of the loans ranges from 1 to 6 years, with an average of 2.3 years.

To inspect the role of distance on credit characteristics, Table 4.4 presents the differences across individuals living in different cities. The borrowers located above the mean are charged with a higher interest rate but the amount granted is four times higher than the amount granted to firms located below the mean. This may be explained by the length of the credit contract, firms located above the mean have a credit contract for 2.25 years and firms located below the mean have contracts for 8.8 months.

4.5 Network and Market Segmentation Analysis

Access to finance is related to prohibitive costs or to barriers, such as travel distance. We have stated that distance is cost related with transport and informational costs. When banks can reuse borrowers' information from repeated transactions, such "relationship banking" creates value for both the borrowers and the relationship banks (Boot, 2000). Many empirical studies also document that relationship banking lowers issuing and borrowing costs and helps relationship banks win future business from clients (Drucker and Puri, 2004; Shenone, 2004; Yasuda, 2005; Bharath, et al., 2007, 2011; Fernado, et al., 2012). Then, bilateral credit relations are affected by both partners' interactions.

In this Section, we present a methodology to show the credit interactions among cities through a network system that then we use to define geographical credit sub-markets.

4.5.1 Network analysis

Loan network is an example of a co-affiliation network with binary relationships between members of two sets of items[52]. Our two sets are banks and firms. The binary relation that connects them is the credit. Since we are interested in the loan arrangement process (or the patterns of ties) and we define loan co-affiliation to represent the national loan market network and clusters to define segments of the market.

Networks are characterized by a set of measures that explain their size and complexity. Size is measured by the number of nodes in the network. We focus on three measures: in-degrees, out-degrees and, cluster.

The relationship between networks and clusters, deserves special attention. Clustering can be seen as a property of the network, or as a means to identify groups or clusters in the network (Opsahl and Panzarasa, 2009). For the purpose of this study, we use latter perspective and consider the local cluster coefficient which is a node characteristic (De Bruyne et al., 2013). Two elements are core in most cluster definitions (Catini et al., 2015). First, clusters are constituted by related activities. Second, clusters are geographically proximate groups of interlinked individuals and organizations.

In this Section, a cluster method is presented that takes into account the patterns among co-located cities. We start at the micro level, employing a geographical aggregation. The algorithm is inspired by the Bubble Cluster Algorithm[53] to construct cities without the use of administrative subdivisions[54]. The

[52] For a revision of affiliation, networks see Borgatti and Halgin (2011). Boss et al (2013) use affiliation networks to analyze syndicate loans.
[53] The advantage of the BBC method is that it only uses the relevant data for the problem and the rest. For analyzing credit clusters the relevant data are just those cities that have bank offices.
[54] Catini et al. (2015) use a City Cluster Algorithm to define geographical clusters. The algorithm requires connected nonzero population cells (Rozenfeld et al. 2008).

clustering procedure is performed by repeating the following steps until all points are assigned to clusters:

- set k-n-1 partitions of the data,[55] where k =maximum number of partitions and n = irrelevant partition;
- take one arbitrary location and assign it to a new cluster;
- find all locations closer than *d* to the previous point and assign them to the same cluster; and,
- recursively add locations closer than *d* to at least one location already in the cluster until each cluster fulfill two requirements:
    - each cluster must contain at least one city, and
    - each city must belong to exactly one group.

Before performing the cluster analysis, variables are converted to z-scores (subtracting the mean and dividing by the standard deviation) to avoid giving more weight to any one variable because of its unit of measure. The first attempt to determine the number of clusters is the Calinski and Harabasz pseudo F-statistic stopping rule is adopted (Calinski and Harabasz, 1974). With this stopping rule, we select a number of cluster to be evaluated in a market segmentation model.

To explore the similarity of economic performance and credit structure of Colombia by our key two dominant vectors (economic performance and credit patterns) a set of variables have been selected with the aim of representing the following dimensions: 1) economic features and 2) credit structure. For economic performance, we use gross product per capita to account for the dynamic growth and wealth of cities in the sample. For the credit structure, we use number of firms in the borrower city and number of operations and value of loans between borrowers and lender to capture the dynamics of credit.

For different combinations of *k-n-1* partitions and *d* distances, the algorithm generates between 5 and 15 possible clusters. In the following Section, we test which of those clusters represent sub-markets.

[55] For the analysis of credit flows, we set the capital city of each department as the potential centroid for each cluster and disregard those departments that do not have bank office (n), meaning that the maximum possible number of clusters is k-n-1 (i.e. maximum 31 clusters, as Colombia has 32 departments)

4.5.2 Market Segmentation Analysis

This Section presents an economic model of market segmentation[56]. The identification of markets through the segmentation of credit markets also elucidates the loan markets. Horiuchi (1988) and Kanou (1998) study market segmentation in Japan by analyzing differences on interest rates by prefecture. Osborne (1988) examined whether U.S. loan markets were segregated into six regions by estimating demand elasticity of each region and examining the correlation of risk premiums between regions. The existence of difference in interest rates is not sufficient evidence for the segmentation of loan markets. Bank loans are highly heterogeneous goods, because they are differentiated by the characteristics of loan contracts, such as default risk, terms of the loans, the size of the loans, and the amount of collateral. Thus, the loan interest rates can differ based on characteristics other than bank location. If loan markets are segmented, the loan interest rate is determined by the demand for and the supply of loans for each market.

We follow Kano and Tsutsui (2003) to derive a reduced form of loan interest rates assuming that the markets are segmented by cluster. If the credit market is segmented by a proposed cluster, the loan interest rate r_j, is determined by the demand for and the supply of loans of each cluster.

Assuming that the loan demand of cluster j, L_j^D:

$$L_j^D = a_0 - a_1 r_j + a_2 Y_j \tag{4.1}$$

where $a_1, a_2 > 0$, Y is the income of the cluster j[57] and r_j the interest rate. The loan supply function from a bank that maximizes its profit in an oligopolistic market. Bank i raises its funds from deposits, d_i, and lends loans, l_i, and call loans, c_i. Thus, the bank's budget constraint is:

$$c_i + l_i = d_i \tag{4.2}$$

[56] Even if the markets are segmented, the segmentation cannot be perfect because bank operations interact through the branch network of city banks in the large cities, and adjacent prefectures through the activities of the branches of the local institutions that have their head offices in the adjacent prefectures. In other words, bank markets partially overlap (Kano and Tsutsui, 2003).

[57] We focus on credit market and assume that income is exogenously determined

Profits of the bank are

$$\pi_i = r_j(L_j)l_i + r^c c_i - r_j^D d_i - f(l_i, d_i) \quad (4.3)$$

where $r_j(L_j)$ is the inverse demand function, and $L_j = \sum_{i \in I} l_i$, the total amount of loans in cluster j, r^c and r_j^D are the call and deposit interest rates, respectively and, $f(l_i, d_i)$ is the cost function with the usual non-increasing assumption and with the following quadratic description $f(l_i d_i) = z_0 + z_1 l_i + z_2 l_i^2 - z_3 l_i d_i + z_4 d_i + z_5 d_i^2$, with $z_h > 0$.

The profit maximizing condition for l_i, allowing for the budget constraint yields:

$$l_i = \frac{1}{2z_2}(r_j - r^c) - \frac{1}{2z_2}\frac{1}{a_1} l_i \frac{\partial L_j}{\partial l_i} + \frac{z_3}{2z_2} d_i - \frac{z_1}{2z_2} \quad (4.4)$$

Summing over the banks of the same cluster *j* yields:

$$L_j = \frac{1}{2z_2}(r_j - r^c) - \frac{1}{2z_2}\frac{1}{a_1} \sum_{i \in K} \left(l_i \frac{\partial L_j}{\partial l_i} \right) - \frac{z_1 I}{2z_2} + \frac{z_3}{2z_2} D_j \quad (4.5)$$

Assuming larger banks disburse larger loans $\frac{dL_j}{dl_i} = b\left(\frac{l_i}{L_j^2}\right), b > 0$, (4.5) can be rewritten as

$$L_j = -\frac{z_1 I}{2z_2} + \frac{1}{2z_2}(r_j - r^c) - \frac{b}{2z_2}\frac{1}{a_1} HHI_j + \frac{z_3}{2z_2} D_j$$

or

$$L_j = b_0 + b_1(r_j - r^c) + b_2 D_j - b_3 HHI_j \quad (4.6)$$

Where $b_0 = -\frac{z_1 I}{2z_2}, b_1 = \frac{1}{2z_2}, b_2 = \frac{z_3}{2z_2}, b_3 = -\frac{b}{2z_2}\frac{1}{a_1}$ and assuming r^c constant

Combining (4.1) and (4.6), we have yields:

$$r_j = \kappa_0 + \kappa_1 Y_j - \kappa_2 D_j + \kappa_3 HHI_j \quad (4.7)$$

where $\kappa_0 = \frac{a_0 - b_0}{a_1 - b_1}, \kappa_1 = \frac{a_2}{a_1 + b_1}, \kappa_2 = \frac{b_2}{a_1 + b_1}, \kappa_3 = \frac{b_3}{a_1 + b_1}$. If markets are segmented, the interest rate is affected by Y_j, D_j and HHI_j. From the BBC algorithm, the possible number of cluster is between 5 and 15. The next step is to test the market segmentation for each of these clusters.

In this model, we examine if the loan interest rates differ across clusters after adjusting for borrower characteristics (i.e. industry characteristics). We also include bank size, as a variable affecting

the bank's interest rate. The assets level for each bank is the measure of bank size and gross product of a cluster as the measure of *Y*. Summing over the deposits of banks in cluster *j*, *HHI* is calculated for each cluster based on the loans disbursed in that cluster.

The estimation results are shown in Table 4.5. The coefficients of Y, D and HHI present the correct sign and are significant at 1% level and 5% when the number of clusters to evaluate is 7.The results imply that the loan markets are segmented when we consider the 7 geographical markets presented in Figure 4.10.

4.6 Credit Gravity Model

In this Section, we present a gravity model to analyze the credit flow in a network framework. Considering distance as a lending barrier, we claim for the intuition of previous gravity models (i.e. migration, trade, foreign direct investment) by assuming that credit behaves like the Newtonian law of gravitation. Then, the basic spatial interaction can be expressed by:

$$L_{ij} = \frac{\beta_0 P_i^{\beta_1} P_j^{\beta_2}}{D_{ij}^{\beta_3}} \tag{4.8}$$

where L_{ij} is the credit from *i* to *j*; β_0 is a constant; P_i is the firms' population of the borrower city; P_j is the firms' population of the lender city;[58] and, D_{ij} is the distance between *i* and *j*, broadly constructed to include all factors that may create credit resistance. (In what follows, I will continue using subscript *i* to denote the lender city and *j* to denote the borrower city.)

Silva and Tenreyro (2006) point out that the analogy with Newton's law of physical force clashes with the observation that there is no set of parameters for which (4.8) will hold exactly for an arbitrary set of observations. To account for deviations from the theory, the following is a basic stochastic version of the equation used in trade empirical studies:

[58] The empirical estimations of gravity models use population or GDP as proxies for potential demand and supply of goods. Because the focus of our paper is on commercial loans, we use city domestic product and, number and size of firms.

$$L_{ij} = \beta_0 P_i^{\beta_1} P_j^{\beta_2} D_{ij}^{\beta_3} \eta_{ij} \quad (4.9)$$

Some authors argue that (4.9) does not consider omitted variable bias. One solution, is to augment the traditional gravity equation with time, origin, and destination fixed effects, leading to:

$$L_{ij} = \beta_0 P_i^{\beta_1} P_j^{\beta_2} D_{ij}^{\beta_3} e^{\theta_i d_i + \theta_j d_j} \eta_{ij} \quad (4.10)$$

where η_{ij} is the error term with $E(\eta_{ij}|.) = 1$ and independent from the regressors and, $\sigma_\eta^2 = \sigma$.

The standard in the gravity literature is to log-linearize (4.10) and estimate the parameters of interest by least squares,

$$\ln L_{ij} = \ln \beta_0 + \beta_1 \ln P_i + \beta_2 \ln P_j + \beta_3 \ln D_{ij} + \ln \eta_{ij} \quad (4.11)$$

The validity of these procedures depends on the assumption that η_{ij} is statistically independent of the regressors and holds constant across observations (when the data are a panel). If this condition does not hold, it violates the consistency of OLS. Evidence finding that the error terms in the log-linear specification of the gravity equation are heteroskedastic violates the assumption that η_{ij} is statistically independent of the regressors and suggests that this estimation method leads to inconsistent estimates of the elasticities of interest (Silva and Tenreyro, 2006).

One problem related with the analogy between the Newtonian law and the gravity equation is that gravitational force can be very small, but never zero, whereas credit between several pairs of cities is literally zero. In many cases, these zeros occur because there was no credit between a pair of cities in a specific period (i.e. high costs between small distant cities). Zeros may also be the result of rounding errors. If credit is measured in millions, it is possible that for pairs of cities for which bilateral credit did not reach a minimum value to register, these operations are reported with zero. If these rounded-down observations were partially compensated by rounded-up ones, the overall effect of these errors would be relatively minor. However, the rounding down is more likely to occur for small or distant places, and therefore the probability of rounding down will depend on the value of the covariates, leading to the

inconsistency of the estimators. Finally, presence of zeros may be explained because there are no bank offices in a specific city.

The zero observations pose no problem for the estimation of gravity equation in the multiplicative form but this is clearly a problem for the log-linear specification. Even if all observations of the dependent variable are strictly positive, the expected value of the log-linearized error will depend, in general, on the covariates and, hence, least squares will be inconsistent.

To deal with the zeros problem, some empirical studies drop the pairs with zero data set and estimate the log-linear form by least squares. Rather than throwing away the observations with zero, some authors estimate the model using ln (1+x) as the dependent variable or use a *tobit* estimator. However, these procedures depend on the data and may lead to inconsistent estimators of the parameters of interest. Santos and Tenreyro (2006) propose the Poisson pseudo-maximum-likelihood (PPML) estimator, which is often used for count data. The advantage is that to be consistent, the data do not have to be Poisson and the dependent variable does not have to be an integer (Gourieroux, Monfort, and Trognon, 1984).

A source of endogeneity recently introduced in the gravity trade literature is the impact of third partners[59]. For our study, credit affects remote cities with large price indices quite differently than centrally located cities. Omitting the price index potentially leads to misspecification. Suppose that a firm located at the periphery of Bogota takes out a loan with a bank centrally located in Bogota. If credit costs between the two cities rise, the price index of the peripheral city will increase more than a non-peripheral city because Bogota is the main lender. The omission of this effect will bias downward the coefficient on the bilateral effects.

To assess the impact of both credit partners' interactions we use the network approach presented in Section 4.5. Similar as Bruyne, Magerman and van Hove (2013), we focus on three measures of the

[59] Feenstra (2003); Anderson and van Wincoop (2003); Bruyne, Magerman and van Hove (2013)

network: in-degrees, out-degrees and, cluster[60]. Degrees and clustering are used as the network indicators. Degrees consider only links between the node under consideration and its neighbors. Clustering takes into account the links between neighbors and nodes. Figure 4.11 plots the kernel density for borrower and lender degrees. In the first panel, small core (cities with many borrowers) and high periphery (cities with few borrowers) are observed. In 2006, the number of periphery cities increases while the number of core cities decreases. For borrowers presented in Figure 11(b), mostly core cities are observed, suggesting that cities have credit relations with few banks. In 2006, the curve shifts to the right. Here, the number of city lenders increases as the number of banks increases in those cities. The correlation between lender degrees and borrowers degrees is very low (0.17 in 1998 and 0.30 in 2006), suggesting that cities with high lending ties have low borrowing ties. The first panel of Figure 4.12 presents the correlation between the lender degrees and distance, which indicates a positive linear relation whose variance increases with distance. In the second panel, the relation between the borrower degrees is presented and evidence of a linear relation is not clear, but there is a long inverse *"U"* that peaks at 400 km. Therefore, while lenders increase their credit relations with the distance borrowers, they keep the same number of ties between 7 km and 400 km, but after this point they reduce credit relations. Variable ties measure years of a credit relation between two municipalities. The graphs indicate that lenders maintain credit relations with the closest borrowers (Figure 4.13).

The next network variables presented are clustering coefficients (Figure 4.14). Here, the coefficients are very low, which implies that cities are not affected by the credit flow of third cities. The upward shift at low levels of density in 2006 indicates that networks become more connected.

[60] The variables are calculated in Matlab by first identifying the direct credit relations and then the indirect credit relations inside the clusters identified in Section 4.5 (see Appendix 1 for the formulas).

4.6.1 Empirical Model

The following is the augmented gravity model based on (4.11)[61]:

$$\ln L_{ijt} = \ln \beta_0 - \beta_1 \ln f_{ijt} + \beta_2 \ln y_{it} + \beta_3 \ln y_{jt} + \beta_4 \ln firms_{jt} + \beta_5 \ln size_{jt} + \beta_6 \ln pop_{ijt} + \beta_7 hhi_{jt} + \beta_8 \ln d_{it}^{out} + \beta_9 \ln d_{jt}^{in} + \beta_{10} \ln c_{it} + \beta_{11} \ln c_{jt} + \beta_{12} capital_{it} + \beta_{13} capital_{jt} + \eta_i + \zeta_j + \nu_t + \varepsilon_{ijt} \quad (4.12)$$

Loan from city i to city j at time t (L_{ijt}) is given by a constant β_0, f_{ijt} is an approximation of the city costs (with $f_{ijt} = \gamma_1 \ln distance_{ij} + \gamma_2 contiguity + \gamma_3 time\_ties_{ijt}$). The attraction variables: the log of the GDPs of both lender and borrower, y_{it} and y_{jt} respectively, number of firms in the borrower city $firms_{jt}$, size of the firms in the borrower city $size_{jt}$ and, the product of the population of cities (lender and borrower) pop_{ijt}. Market power in the borrower city as explained in Section 4.4, hhi_{jt}. The network variables: the out-degree of the lender d_{it}^{out}, the in-degree of the borrower d_{jt}^{in}, and the clustering coefficients of lender and borrower, c_{it} and c_{jt} respectively. The geographical variables to indicate if the lender city is the capital of the department η_i, ζ_j and υ_t are lender, borrower and time dummies which capture non-observed network and macroeconomic factors. ε_{ijt} is the idiosyncratic error term.

Table 4.6 shows a basic exercise to open the discussion about the impact of distance on our variables of interest, credit flows in columns 1 to 4 and, price of credit in columns 5 and 6. The distance is highly significant for value and volume of loans. A 10 % increase in the distance reduces the value of loans by about 5 % and number of operations by about 4.26 %. The bins of distance are included in the estimation leading to the results that greater the distance the less the value of granted loans and the smaller the number of loans in the borrower city.

[61] Following the approach by Anderson and van Wincoop (2003), the exponent on lender GDP, and borrower GDP in (4.12) should be one, so both sides are divided by lender and borrower GDP. All results are estimated using the Stata packages *reghdfe* (Correia, 2015) which estimates large models with multiple levels of fixed effects

The benchmark estimations (i.e. *naive gravity model*) using loan (*intensive margin*) are presented in Table 4.7 and number of operations (*extensive margin*) in Table 4.8 by OLS estimation. Table 4.9 presents a group of selected variables using OLS estimation (columns 1 and 3) and the sensitivity analysis by using PPML estimation (columns 2 and 4). OLS with the city effects level dummies is consistent but not efficient in the presence of heteroscedastic errors. Following Silva and Tenreyro (2006), the estimated model uses PPML to address the fact that only 3 % of our possible observations were nonzero. This procedure performs better than OLS in the presence of heteroscedasticity. In all columns of Tables 4.7 and 4.8, except for column 1, the year fixed effect and city fixed effect are used to control for macroeconomic and local non-observable variables. Distance is controlled by altitude and distance is also included as categorical variable as well as distance between borrower and lender less than 7 km, 55 km, and 400 km; our category of reference was distance greater than 400 km.

In all estimations, distance has a negative impact on the aggregate and categorical forms with one important difference. In PPML estimations (Table 4.9), the aggregated distance coefficient is more negative for intensive and extensive margins. Generally, a 10 % increase in distance reduces loans by about 4–5 % and number of operations by about 3–4 %. To put the results in context, in the sample the median distance between cities is 18 km; thus a one km increase in the median city is equivalent to a 2.50 % decrease in loan (1/18*0.45) and 1.94 % decrease in number of operations (1/18*0.35).

The magnitude of categorical variables decreases in the PPML. These results are consistent with the magnitude of other empirical gravity models and indicate that the farther the borrower city, the higher the costs of granting credit. Road distance is also significant but the data was not available for all bilateral relations. For what follows, straight-line distance is used. Controlling by altitude does not provide the model with additional information, and the result of the squared distance confirms the linear relation between credit flows and distance.[62]

[62] There is no information available for Carmen del Darien in Choco.

The variable *time ties* is included as a matter of reputation of the city, reflecting economic activity and reliable institutions. This yields a positive and significant impact.

Regarding the supply and demand variables, GDP is not relevant but the number of firms is significant when measuring the potential demand for credit. The level of assets is also significant, with opposite sign depending on whether credit is measured through the intensive (positive) or extensive (negative) margin. This implies that the value of loans is higher for large firms but the number of operations is higher for small-sized firms. The PPML estimation yields similar results.

The next group of variables, market power, have mixed results depending on their inclusion in small or large radii. HHI by municipality is not significant in the intensive, but it was relevant for explaining the number of loans between two cities. HHI by department is significant for both intensive and extensive margins in the OLS estimation but it loses power in the PPML estimation. In all cases, when HHI is significant, the sign is negative. None of the measures of HHI by radius is significant when value of loans is the dependent variable and the estimation is by least squares; however, in the PPML estimation, market power at 55 km of radius is highly significant. When allowing for the market power coefficients for the extensive margin model, HHI at 55 km and 400km is significant in the PPML estimation (only HHI at 400 km is significant in the OLS estimation). These results support Novo-Peteiro's (2009) and Boss et al (2015) propositions in two sense: 1) intensive credit margin is more sensitive to local competition and that extensive is more sensitive to cross-local competition and 2) lenders are more conservative when information is harder to collect, especially in competitive markets.

The results reported in Table 4.8 column (14) included the network variables. The control variables remain stable, which is the case for all models considered. Secondly, degrees have a positive and highly significant impact on bilateral trade, where an increase of 10 % in a lender's weighted out-degree increases bilateral credit by almost 5 % per partner on average. A similar reasoning holds for the weighted in-degree of the borrower city; namely, a 10 % increase in weighted in-degree raises bilateral credit with almost 5 % per partner on average. This is a clear network effect where being connected to

more credit partners, will increase bilateral credit. Very competitive lenders active in many markets will grant more credit to one particular destination. This could reflect cities borrowing from many partners appear to have good reputation.

Regarding the clustering coefficient, a higher clustering coefficient has a negative impact on credit. That is, the more connected a city's credit partners, the less bilateral credit between these partners and the initial city will occur. Since clustering is a measure between 0 and 1, a unit increase in clustering of the borrower has a negative impact of around 1.2 % on bilateral credit. It is intuitive that this measure is of an order of magnitude smaller than the direct network effect of degrees, since it entails actions of partners, rather than itself. Hence, the first-order effects of the network are larger than the second-order effects. Cities that are highly clustered are subject to intense competition within their own network. As a consequence their bilateral credit with particular trading partners is reduced. We can conclude that the joint effect of the network variables on credit is positive. While competition within their own credit networks hampers bilateral credit between two partners, this negative effect is more than compensated for the ties with many cities. In the sensitivity analysis using PPML, the sign, size and significance of the coefficients of the network statistics remain robust. This indicates that the coefficients are orthogonal to other regressors in the model, and confidence intervals are tighter.

Finally, geographical variables are included to account for whether the lender or borrower is located in a capital of department, whether the borrower and lender are located in the same department (contiguity), and for the product of the population of cities (lender and borrower). All of these robustness variables are significant in the PPML estimation, but only the borrower's location in the capital of the department is significant in the OLS estimation. Given the high concentration of banks in capital cities and the negative sign of the distance coefficient, the expected positive sign for borrowers' and lenders' being located in a capital city is estimated.

Table 4.10 presents an interest rate analysis. The impact of distance is quite sensitive to the other control variables. A 10% increase in the distance reduces the interest rate by 0.1-0.2, meaning that a one

km increase in the median city is equivalent to a 0.11% decrease in interest rate (1/18*0.20). In addition, the economic conditions of the borrower city matter more than those in the lender city.[63] Small firms are charged lower interest rates and market power impacts at greater distances. Finally, the interest rate depends on the cluster to which the lender city belongs.

4.7 Geographical Market and Moral Hazard

Previous Sections shaped local financial markets. The purpose of this Section is to analyze the impact of local markets on firms, defining the markets as the segments defined in Section 4.5.

Firm's choices are likely to be determined by factors that are related to the characteristics of the firm, as well as to the institutional environment where the firm operates that affect banking activities, such as the cost of monitoring and the ex-post moral hazard which are fueled by asymmetric information between the lender and the borrower.[64] Guiso et al. (2004) claim that, within a single country, local institutional differences can exist and may play a crucial role in determining firm's decisions.

Enforcement is also a key role in firm's decisions. Due to the risk of default and the difficulty to get back the liquidation value of the collateral, enforcement affects the ex-ante availability of agents to provide finance.

Transaction and agency costs mentioned above can be proxied by the physical distance between the bank and the borrower and, explain the success of a loan, as well as capital structure decisions. When information on creditworthiness must be collected at local level, this places the far borrowers at a disadvantage. Hence, repeated interactions lead to collecting sufficient soft information on clients to overcome informational asymmetries, making distance a more binding constraint at the beginning of the credit relationship (Presbitero and Rabelloti, 2013).

[63] One must be cautious about this observation due to the reverse causality of the variables.

[64] This is frequently addressed in the literature; see (DemirgucKunt and Maksimovic 2008, 2002, 1998, 1996a; Cheng and Shiu 2007; Lopez-Iturriaga and Rodriguez-Sanz 2007; Utrero-González 2007; Bianco et al. 2005; Giannetti 2003; Titman et al. 2003; Booth et al. 2001; La Porta et al. 1997, 1998; Rajan and Zingales 1995; Presbitero and Rabelloti, 2013).

Similar, Diamond (1993) and Flannery (1986), argue that the existence of asymmetric information is likely to tilt capital structures toward a higher use of debt. According to Titman et al. (2003), a principal source of the financial constraint, influencing capital-structure, is asymmetric information and the cost of contracting between borrowers and banks. Problems associated with financial constraints are potentially high in presence of a poorly developed financial system. A well-developed financial system can facilitate the ability of a company to gain access to external financing, providing cheaper finance to worthy companies (Guiso et al. 2004). With a well-developed financial system the efficiency of the market helps to avoid opportunistic behaviors.

The first hypothesis we test in this Section is that the lender's monitoring activity and the recipient's moral hazard could depend on the proximity between bank and borrowers. On the lender side, physical proximity, enforcement, homogenous market characteristics make monitoring less expensive, reducing transaction costs. On the borrower side, an opportunistic behavior (diverting the purpose of the loan) is easier the greater the distance from the bank or low enforcement conditions in the market. Hence, we expect that the outcome of the loan improves as long as the bank and the entrepreneur are closer geographically.

In addition, Presbitero and Rabelloti (2013) argue that distance could be a proxy for other transaction costs. A long distance could increase transportation cost up to a point of making the visit to the bank a binding constraint for the entrepreneurial activity. To try to disentangle between these two effects, information versus transportation costs, we also include market size measured as the branch density and the log of deposits in the cluster (Degryse and Ongena, 2005; Benfratello et al., 2008). If distance is a proxy of the information asymmetries, it should become uninformative in explaining the success of the loan as long as the market is bigger since banks are more efficient and information asymmetries reduced opportunistic behavior or borrowers is reduced. Because of the same reasons, we expect market size tightens credit.

Then the second hypothesis is the impact of market size to allow for a higher use of debt since size hampers opportunistic behavior. Finding that local financial development is a determinant of firms' financing decisions may suggest that, despite the international process of capital markets integration, developed local financial intermediaries could still matter for the availability of financing sources stimulating growth.

If firms are able to tap markets other than the local one, local market conditions become irrelevant; however, due to the existence of frictions in the market and especially with regards of small and medium size firms, the local financial market can be still fundamental.

4.7.1 Empirical Model

Our objective is to test how transaction costs and information cost measure through distance and market size affect debt and performance of the loan in a firm. *Operational income* is used as indicator of performance and *leverage* as indicator of debt. We estimate the following equation:

$$\ln y_{i,j,s,t} = \alpha_0 + \alpha_1 \ln distance_{i,j,k} + \alpha_2 \ln market\ size_j + \Lambda_i\gamma' + \Pi_j\eta' + \Gamma_{s,t}\delta' + \varepsilon_{i,s,t} \qquad (4.14)$$

where $y_{i,j,s,t}$ corresponds to operational or leverage. The sub-indexes refers to firm *i* located in market *j*, in industry *s* at time *t*. Fixed effects by year, industry and city where the firm is located are included to control for all macroeconomic and city factors not observed that may affect the decisions of the firms. $\Lambda_i, \Pi_j, \Gamma_{s,t}$ is firm, market and year/sector-year fixed effects, respectively, and $\varepsilon_{i,s,t}, \upsilon_{i.j.s,t}$ are the corresponding error terms with standard normal distribution.

One problem of the estimation is the censored regressor distance. The variable distance is constructed by measuring the distance between borrower and lender under the assumption that borrower choses the closest bank. A value of zero means that the bank with which the firm has a credit relation is in the same city as the firm. Rigobon and Stoker (2007) point out that the use of censored regressors can lead to "expansion bias" or estimated effects that are too large in absolute value and can be mitigated by dropping the censored observations. However, Rigobon and Stoker (2007) point out that these

omissions may introduce a selectivity problem from selecting the sample in an endogenous way. To address this problem, we impute the zero values with the maximum distance a borrower can travel inside the same city (i.e. distance between two random extreme points of the city).

In addition, the non-random sampling of the dataset must be considered. Not all the firms submit information to SS: 1) small firms are not obligated to submit information, 2) firms must meet a threshold in terms of the level of assets and, 3) the *superindente* may require information from specific industry to address specific policies. Our sample equation is presented in (4.15), there we include as regressors the ratio of sales and assets of the firm and a set of dummy variables representing the period a specific *superindent* was in charge.

$$y_{1,i,j,s,t} = \mathbb{I}\{z_{i,j,s,t}\lambda' + \Lambda_i\alpha' + \Pi_j\chi' + \Gamma_{s,t}\tau' + \upsilon_{i,j,s,t} > 0\} \quad (4.15)$$

While $y_{1,i,\mathrm{j},s,t}$ and $z_{i,\mathrm{j},s,t}$ are always observed, $\ln y_{i,\mathrm{j},s,t}$ is only observed when $y_{1,i,s,t} = 1$. Our estimation procedure is applied as follows: We estimate parameters $\hat{\lambda}'$, $\hat{\alpha}'$, χ' and τ' in (4.15) with a probit of $y_{1,i,s,t}$ on $z_{i,s,t}$ using all the observations. After testing for the significance of our instruments, we proceed to estimate the inverse mills ratio $\hat{\lambda}^{M}_{i,\mathrm{j},s,t} = \frac{\phi(z_{i,j,s,t}\lambda' + \Lambda_i\alpha' + \Pi_j\chi' + \Gamma_{s,t}\tau')}{1-\Phi(z_{i,j,s,t}\lambda' + \Lambda_i\alpha' + \Pi_j\chi' + \Gamma_{s,t}\tau')}$. Finally, we incude the mills ratio term in (4.14) on the observations where $y_{1,i,s,t} = 1$. The following is the equation we estimate

$$\ln y_{i,\mathrm{j},s,t} = \alpha_0 + \alpha_1 \ln distance_{i,j,k} + \alpha_2 \ln market\ size_j + \alpha_3\hat{\lambda}^{M}_{i,\mathrm{j},s,t} + \Lambda_i\gamma' + \Pi_j\eta' + \Gamma_{s,t}\delta' + +\varsigma_{i,\mathrm{j},s,t} \quad (4.16)$$

Models in Tables 4.11 and 4.12 are estimated with a linear model corrected for the selection bias problem. A negative coefficient of distance when *leverage* and *operational income* are present suggests that the physical distance between the bank and the borrower increases the costs of monitoring and, therefore, leads to opportunistic behavior by borrowers. The costs of monitoring increase with distance, especially in the presence of opaque information. In this case, firms have incentives to make an improper use of the loan and this will be reflected in the performance of the firm.

The effect of physical distance on leverage is negative and statistically significant for all scenarios, with the greatest coefficient for small firms. On the other hand, market size is negative for small firms and, positive, and statistically significant. The results suggest that distance is a proxy for transportation costs, especially in the presence of opaque information.

By looking at the effect of physical proximity on income (Table 4.11), we try to disentangle alternative costs of distance. We see that the coefficients on the distance separating the borrower from financial institutions is always negative and statistically significant, with the exception of small firms. This result suggests that the transaction costs in monitoring still matters especially for medium sized firms. The more severe the asymmetric information on the actual use of the money lent, the greater may be the temptation for the recipient to pursue other targets (Presbitero and Rabelloti, 2003). The effect of market size is homogenous for all firms: it is positive and statistically significant, especially for small firms

4.9 Conclusions

Local financial development is one of the engines to growth. This objective has been addressed in developing countries through the commercialization of banking services. Frictions in credit market emerge from transportation cost and informational asymmetries between lenders and borrowers. More recently, physical distance has been presented as a proxy for the costs associated with transportation and information asymmetries (Alessandrini, Fratianni and Zazzaro, 2009). The advantage of physical proximity is mirrored by the spatial diffusion of bank branches, which reduces the distance between the institution and local costumers.

Banking services also shape interactions between lenders and borrowers that reflect a network. Nevertheless, boundaries of network communities and geographical areas are not clearly identified. Therefore, most of the available evidence has used standard industrial classification systems and administrative regions or zip codes to characterize markets.

In this chapter, we analyze credit flows in Colombia to identify sub-markets and analyze their impact on credit flows between cities and on firm's performance. To identify the markets we use a cluster algorithm combined with a market segmentation model. We find that credit market is segmented in 7 geographical markets.

For the analysis of credit flows between cities in Colombia, we use a gravity model for commercial loan considering network theory that includes the traditional variable of distance and three network variables: in-degrees, out-degrees and cluster that measure financial development, competitiveness and potential competition effects.

Distance must be considered as proxy for transportation costs while network variables reflect market drivers. Lenders cluster by destination, meaning that they have credit relations at an 18 km distance. A one km increase in the median city is equivalent to a 2.50 % decrease in loans and 1.94 % decrease in number of operations. The negative impact of distance reflects the low presence of banking institutions in some areas, meaning credit markets in Colombia are local and the high cost to connect credit markets.

Regarding market characteristics, we find a positive impact of out-degrees on credit, meaning that the more interaction a city has, the more interactions it will have with another city. The impact of in-degrees on credit is positive as well, implying the more affiliation a city has, the more likely it is that one particular city has a relation with that city. These two characteristics reflect financial relations are more likely between cities with better institutions. By contrast, clustering has a negative impact on credit. This is an indication of potential competition effects. The higher the clustering coefficient, the stronger the relation between two cities.

For the analysis of the firm, we find that distance represents a transaction, thus a prohibited cost for having access to credit. Additionally, we test the impact of the development of the geographical market and find that whereas it contributes to alleviate the transportation costs, it threatens the use of the loan when the leverage is high. This result is the outcome of poor screening. We find that transactional costs and moral hazard increases with distance for small- and medium-sized firms, given that monitoring

becomes more expensive for the bank, and distant borrowers have greater incentives to adopt opportunistic behaviors, especially when markets are not developed.

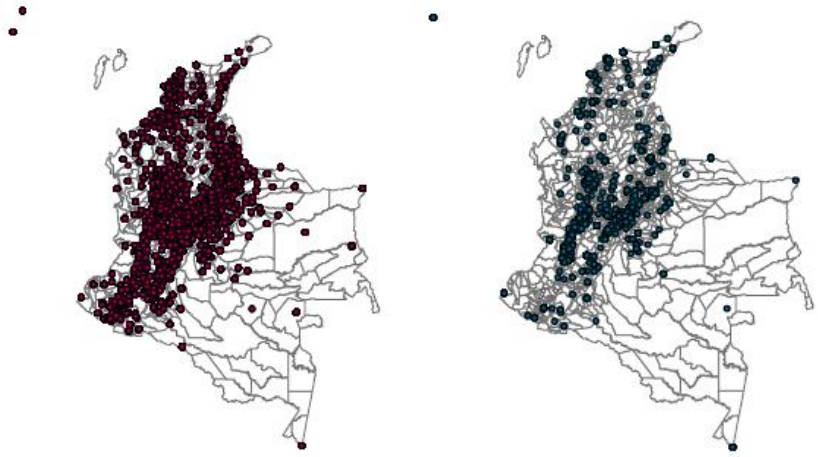
The role of geographical distance in credit market reveals the limited scope of technological development in credit market in Colombia. The market in turn, is divided in 7 geographical markets that reveal that each of them has specific-common financial and competitiveness characteristics that enhance the relations among them. These differences are translated in the decisions of the firms. Specifically, we find that geographical distance is a proxy for transportation costs and information costs. Development of the financial market along with screening practices alleviates informational costs.

Our results align with all contributions suggesting a stronger impact of information in more competitive credit markets. When competition is high, moral hazard may be more salient because defaulting borrowers can easily move to an outside lender. Lender competition can also exacerbate adverse selection as investments in information acquisition fall (Hauswald and Marquez, 2006) and banks reallocate credit to captured borrowers of lower quality (Dell'Ariccia and Marquez, 2004). Over-borrowing is more likely to occur in high-competition markets too (Parlour and Rajan, 2001).

Figures

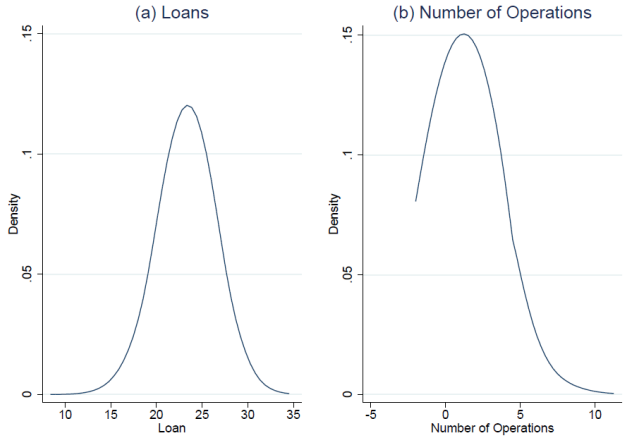
Figure 4.1. Location of Bank Offices and Firms

(a) Location of Banks (b) Location of Firms



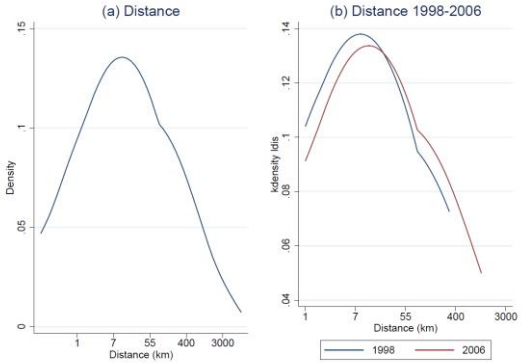
Source: Own authors' Calculations. Note: Data of firm location was extracted from SS and bank location from SFC's OAC report.

Figure 4.2. Intensive and Extensive Margin



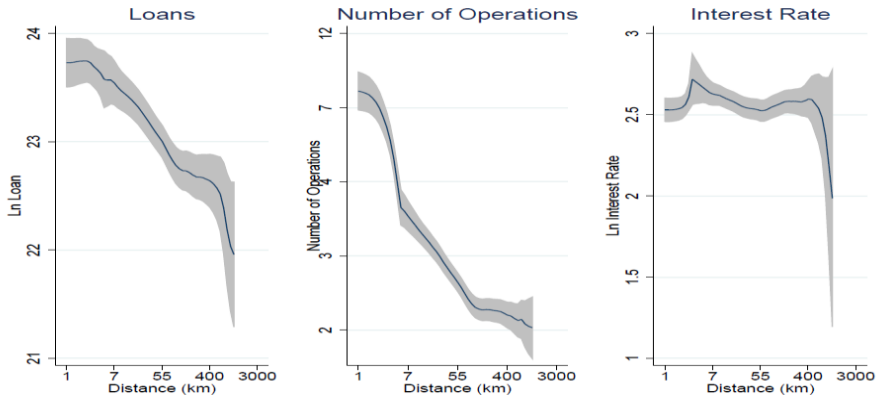
Source: Own authors' Calculations for cities with loans. Note: Data on loans and number of operations were extracted from SFC's format 341.

Figure 4.3. Straight Line Distance



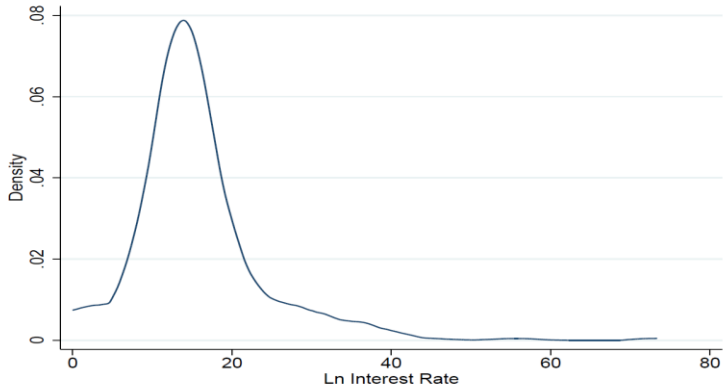
Source: Own authors' Calculations based on Euclidean distance formula.

Figure 4.4. Relation between Distance and Intensive and Extensive Margin and Interest Rate



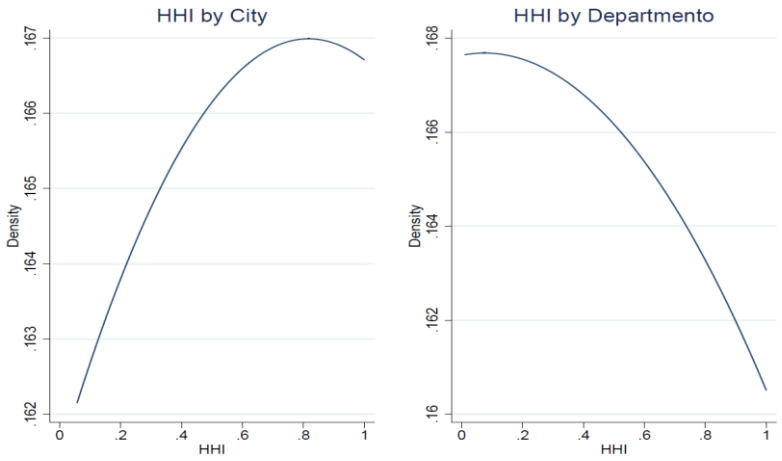
Source: Own authors' Calculations for cities with bilateral relation (2,223). Note: Data on loans and number of operations were extracted from SF's format 341. Distance from borrower city to lender city was calculated with information extracted from SFC's format 341 and OAC report.

Figure 4.5. Interest Rate



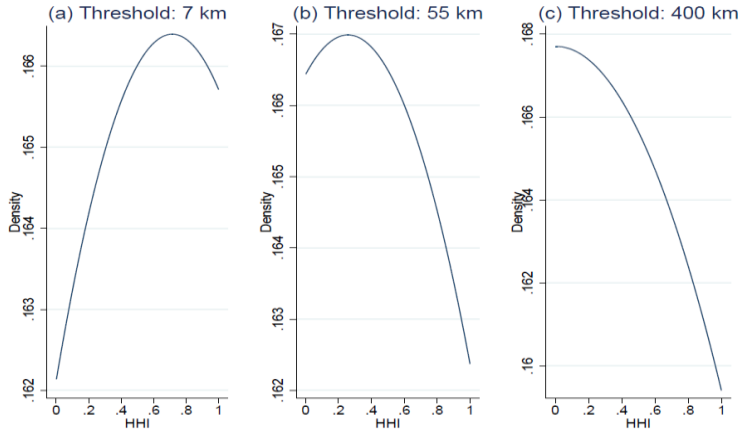
Source: Own authors' Calculations for cities with bilateral relation (2,223). Note: Data on interest rate was extracted from SFC's format 341.

Figure 4.6. HHI by City and Department



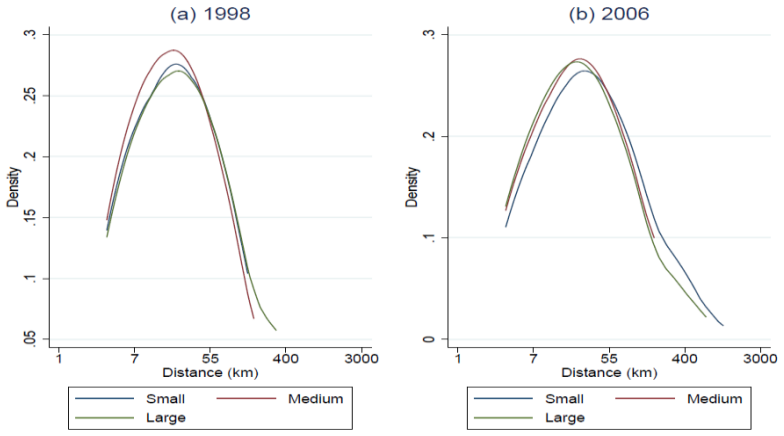
Source: Own authors' Calculations for cities with bilateral relation (2,223). Note: Data of total supply of credit was extracted from SFC's OAC report.

Figure 4.7. HHI by Distance



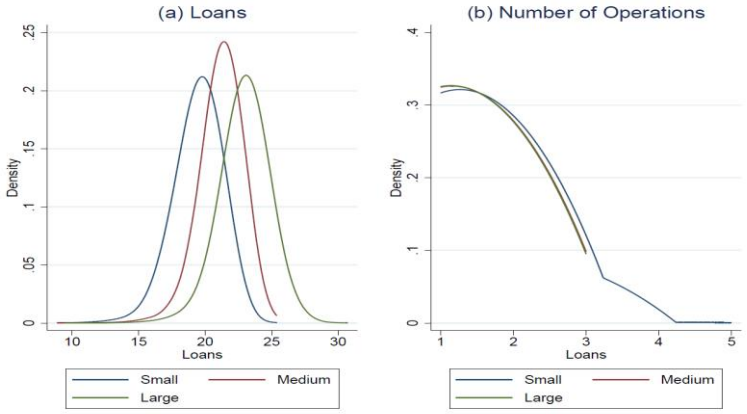
Source: Own authors' Calculations for cities with bilateral relation (2,223). Note: Data of total supply of credit was extracted from SFC's OAC report. Distance from borrower city to lender city was calculated with information extracted from SFC's format 341 and OAC report.

Figure 4.8. Distance by Firm Size



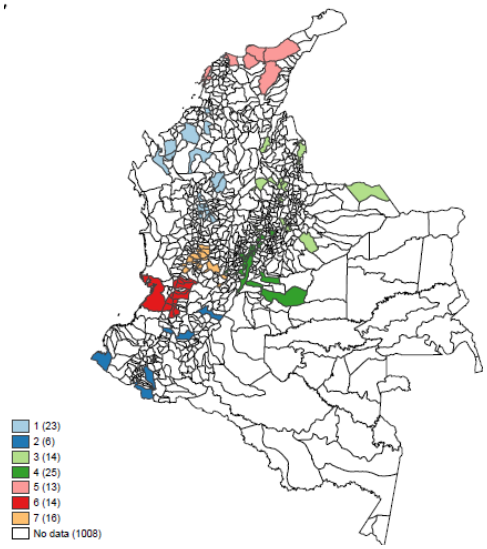
Source: Own authors' Calculations. Note: Data of firm location was extracted from SS and bank location from SFC's OAC report.

Figure 4.9. Credit Measures by Firm Size



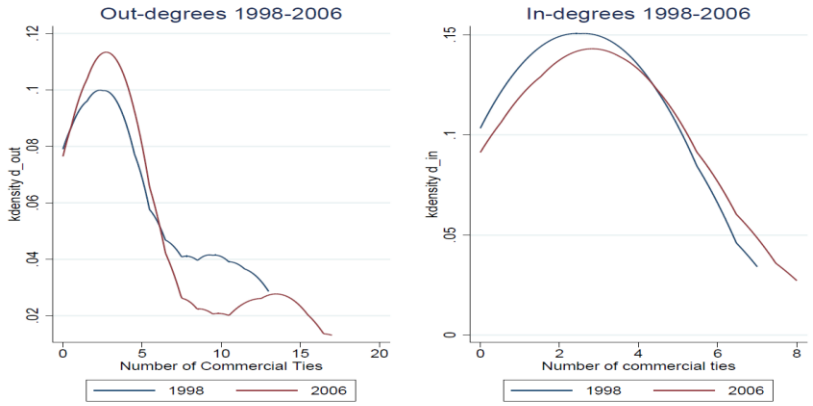
Source: Own authors' Calculations. Note: Data on loans and number of operations were extracted from SF's format 341

Figure 4.10. Credit sub-markets



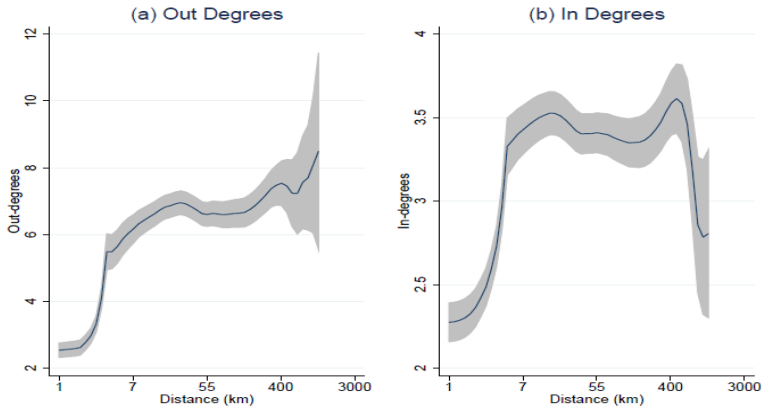
Source: Own authors' Calculations

Figure 4.11. In-degrees and Out-degrees



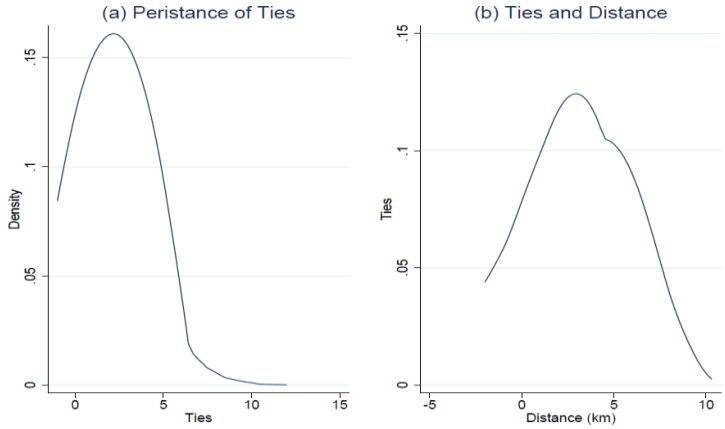
Source: Own authors' Calculations for cities with bilateral relation (2,223). Note: Data of number of ties was extracted from SFC's format 341. Each panel considers years 1998 and 2006. Panel a: Out-degree distribution. Panel b: In-degree distribution.

Figure 4.12. Correlation between Degrees and Distance



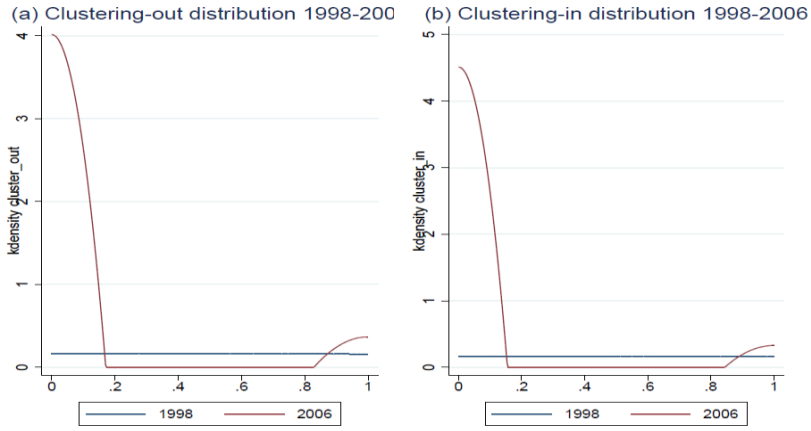
Source: Own authors' Calculations for cities with bilateral relation (2,223). Note: Data of number of ties was extracted from SFC's format 341. Distance from borrower city to lender city was calculated with information extracted from SFC's format 341 and OAC report.

Figure 4.13. Credit Ties



Source: Own authors' Calculations for cities with bilateral relation (2,223). Note: Data of number of ties was extracted from SFC's format 341. Distance from borrower city to lender city was calculated with information extracted from SFC's format 341 and OAC report.

Figure 4.14. Clustering-in and Clustering-out



Source: Own authors' Calculations for cities with bilateral relation (2,223).

Tables

Table 4.1. Financial Depth across Cities

FD index in 1998		FD index in 2006	
City	Departamento	City	Departamento
Amalfi	Antioquia	Amalfi	Antioquia
Barbosa	Antioquia	Apartado	Antioquia
Bello	Antioquia	Barbosa	Antioquia
Caldas	Antioquia	Bello	Antioquia
Copacabana	Antioquia	Belmira	Antioquia
Envigado	Antioquia	Caldas	Antioquia
Girardota	Antioquia	Copacabana	Antioquia
Guarne	Antioquia	Envigado	Antioquia
Itagui	Antioquia	Guarne	Antioquia
La Estrella	Antioquia	Itagui	Antioquia
Medellin	Antioquia	La Ceja	Antioquia
Rionegro	Antioquia	La Estrella	Antioquia
Sabaneta	Antioquia	Medellin	Antioquia
Barranquilla	Atlantico	Sabaneta	Antioquia
Malambo	Atlantico	Amaga	Antioquia
Soledad	Atlantico	Barranquilla	Atlantico
Bogota	Bogota DC	Malambo	Atlantico
Cartagena	Bolivar	Sabanagrande	Atlantico
Turbaco	Bolivar	Soledad	Atlantico
Chinchina	Caldas	Bogota	Bogota DC
Villamaria	Caldas	Cartagena	Bolivar
Caloto	Cauca	Turbaco	Bolivar
Cajica	Cundinamarca	Sogamoso	Boyaca
Chia	Cundinamarca	Soraca	Boyaca
Cota	Cundinamarca	Chinchina	Caldas
Mosquera	Cundinamarca	Manizales	Caldas
Soacha	Cundinamarca	Caloto	Cauca
Suesca	Cundinamarca	Popayan	Cauca
Tenjo	Cundinamarca	Puerto Tejada	Cauca
Tocancipa	Cundinamarca	Santander De Quilichao	Cauca
San Martin	Meta	Sahagun	Cordoba
Dos Quebradas	Risaralda	Cajica	Cundinarmarca
Bucaramanga	Santander	Cota	Cundinarmarca
Giron	Santander	Facatativa	Cundinarmarca
Sincelejo	Sucre	Guacheta	Cundinarmarca
Fresno	Tolima	Madrid	Cundinarmarca
Lerida	Tolima	Mosquera	Cundinarmarca
Cali	Valle del Cauca	Sibate	Cundinarmarca
Cartago	Valle del Cauca	Soacha	Cundinarmarca
Palmira	Valle del Cauca	Subachoque	Cundinarmarca
Tulua	Valle del Cauca	Suesca	Cundinarmarca
Yotoco	Valle del Cauca	Tabio	Cundinarmarca
Yumbo	Valle del Cauca	Tocancipa	Cundinarmarca
		Ubate	Cundinarmarca
		Venecia-Ospina	Cundinarmarca
		Villeta	Cundinarmarca
		La Plata	Huila
		Aracataca	Magdalena
		Cienaga	Magdalena
		Santa Marta	Magdalena
		Guamal	Meta
		San Martin	Meta
		Villavicencio	Meta
		Ipiales	Narino
		Pasto	Narino
		Tumaco	Narino
		Los Patios	Norte de Santander
		Calarca	Quindio
		La Tebaida	Quindio
		Dos Quebradas	Risaralda
		Pereira	Risaralda
		Santa Rosa De Cabal	Risaralda
		Aratoca	Santander
		Bucaramanga	Santander
		Floridablanca	Santander
		Giron	Santander
		Ambalema	Tolima
		Espinal	Tolima
		Flandes	Tolima
		Guamo	Tolima
		Ibague	Tolima
		Buenaventura	Valle del Cauca
		Buga	Valle del Cauca
		Cali	Valle del Cauca
		Candelaria	Valle del Cauca
		El Cerrito	Valle del Cauca
		Jamundi	Valle del Cauca
		La Union	Valle del Cauca
		Palmira	Valle del Cauca
		Pradera	Valle del Cauca
		Toro	Valle del Cauca
		Tulua	Valle del Cauca
		Yotoco	Valle del Cauca
		Yumbo	Valle del Cauca

Source: Own authors' Calculations. Note: We calculate the financial development indicator (ratio of Total Credit to City Domestic Product) across cities of Colombia for each of year in our sample, then as Ayyagari, Demirgüç-Kunt and Maksimovic (2013), we define the dummy variable FD that takes the value 1 for state-years that are at or higher than the median value of Credit/SDP across states in a given year.

Table 4.2. Summary Statistics of Selected Variables

Bilateral relation	2223				
Same city	717				
	Mean	Median	Standard Deviation	1st Percentile	99th Percentile
Ln Loan	23.31	23.38	2.68	16.32	29.57
Number of Operations	38.75	2	354.82	1	541
Interes Rate	15.53	14.30	8.22	0	40
Distance	49.79	17.96	88.37	0	356.04
In Degrees	3.04	3	3.75	0	9
Out Degrees	5.33	3	25.01	0	19
Cluster In	0.05	0	0.05	0	1
Cluster Out	0.07	0	0.06	0	1

Source: Authors' Calculations based on Superintendecia Financiera de Colombia report

Table 4.3. Firm Credit relationships characteristics

	Mean	Median	Standard Deviation	1st Percentile	99th Percentile
Lending Relationships					
Distance (km)	5.05	0.00	26.12	0.00	130.87
Same City	0.89	1.00	0.32	0.00	1.00
Number of Relations	5.22	4.00	3.52	1.00	16.00
Number of Loans	1.21	1.00	0.41	1.00	2.00
Loan characteristics					
Interest Rate	15.55	14.58	8.62	0.00	44.50
Length (years)	2.31	2.00	1.13	1.00	6.00
Amount (Ln)	21.16	21.21	2.27	15.57	26.12

Source: Authors' Calculations based on Superintendecia Financiera de Colombia report

Table 4.4. Firm Credit relationships characteristics and distance from the bank

	Distance from Bank		t-test
	Below Mean	Above Mean	p-value
Interest Rate	5.052	14.712	0.000
Length (years)	0.888	2.246	0.000
Amount (Ln)	5.218	22.086	0.000
Number of Loans	1.205	1.148	0.000
Ratio of Collateral to Liabilities	15.547	1.130	0.139

The mean distance is 5 km. The last column reports the p-value of the mean comparison test.

Source: Authors' Calculations based on Superintendecia Financiera de Colombia report

Table 4.5. Market segmentation

Dependent Variable: Interest Rate	All firms	
GDP (ln)	0.0209	*
	0.0122	
Deposits (ln)	-0.0363	***
	0.0060	
HHI	0.6488	***
	0.1769	
N	66,296	
R2	0.7938	
Year Fixed Effects	Yes	
Industry Fixed Effects	Yes	
Bank size Fixed Effects	Yes	

***, ** and * are significant at 1%, 5% and 10% respectively.

Table 4.6 Comparison among Relevant Variables

	1		2		3		4		5		6	
Dependent Variable:	Ln Loan				Ln Number Operations				Ln Interest Rate			
Circular Distance	-0.4968	***			-0.4259	***			-0.0218	*		
	0.0346				0.0276				0.0116			
Distance < 7km			8.7155	***			6.9308	***			-0.1091	
			1.2573				0.9421				0.2334	
Distance < 55 km			7.3888	***			5.7319	***			-0.1466	
			1.2681				0.9758				0.2374	
Distance < 400 km			6.5347	***			5.0511	***			-0.2100	
			1.2930				0.9884				0.2437	
N	2,100		2,100		2,223		2,223		2,194		2,194	
R2	0.7720		0.7673		0.8170		0.8073		0.4360		0.4360	
Time Fixed Effects	Yes		Yes		Yes		Yes		Yes		Yes	
City Fixed Effects	Yes		Yes		Yes		Yes		Yes		Yes	

***, ** and * are significant at 1%, 5% and 10% respectively.

Note: Cluster by distance

Table 4.7.OLS Gravity Estimates for Loans

Dependent Variable: Loan (ln)	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15	
Straight Distance (ln)	-0.2107	***	-0.4968	***	-0.4707	***			-0.6617	***			-0.4700	***	-0.5372	***	-0.5387	***	-0.5402	***	-0.5378	***	-0.5374	***	-0.5374	***	-0.4367	***	-0.4367	***
	0.0389		0.0346		0.1113				0.1136				0.0474		0.0478		0.0479		0.0478		0.0478		0.0477		0.0478		0.0046		0.0046	
Altitude					0.0584																									
					0.0792																									
Road Distance							-0.2598	***																						
							0.0784																							
Squared Distance									0.0358																					
									0.0226																					
Distance < 7 km											8.7155	***																		
											1.2573																			
Distance < 55 km											7.3888	***																		
											1.2681																			
Distance < 400 km											6.5347	***																		
											1.2930																			
Contiguity													0.1893		0.1214		0.1230		0.1249		0.1215		0.1200		0.1289		-0.0218		-0.0218	
													0.2321		0.2559		0.2558		0.2541		0.2561		0.2556		0.2564		0.0298		0.0298	
Tie Time													0.0905	*	0.1034	**	0.1022	**	0.0992	**	0.1023	**	0.1036	**	0.0986	**	0.0101	*	0.0101	*
													0.0548		0.0422		0.0423		0.0424		0.0423		0.0423		0.0423		0.0058		0.0058	
GDP Lender (ln)															-0.0145		-0.0119		0.0569		-0.0143		-0.0113		-0.0213		0.0084		0.0084	
															0.1746		0.1774		0.1710		0.1765		0.1729		0.1736		0.0319		0.0319	
GDP Borrower (ln)															-0.1864		-0.1899		-0.1941		-0.1885		-0.1860		-0.1831		-0.0214		-0.0214	
															0.1689		0.1693		0.1680		0.1695		0.1688		0.1683		0.0266		0.0266	
Number of Firms (ln)															0.6322	***	0.6344	***	0.6084	***	0.6352	***	0.6318	***	0.6260	***	0.0808	***	0.0808	***
															0.1749		0.1752		0.1662		0.1757		0.1744		0.1725		0.0143		0.0143	
Assets (ln)															0.6857	***	0.6870	***	0.6834	***	0.6867	***	0.6852	***	0.6899	***	-0.0064		-0.0064	
															0.0851		0.0855		0.0865		0.0851		0.0853		0.0854		0.0044		0.0044	
Population															0.0320		0.0267		0.0720		0.0279		0.0326		0.0352		0.2887		0.2887	***
															0.4466		0.4458		0.4352		0.4469		0.4463		0.4439		0.0460		0.0460	
HHI (municipality)																	-0.3278													
																	0.4843													
HHI (*departamento*)																			-4.7444	***										
																			1.7440											
HHI < 7 km																					-0.2537									
																					0.2808									
HHI < 55 km																							0.2490							
																							0.4192							
HHI < 400 km																									-26.6093	*	0.0829		0.0829	
																									13.8515		0.2217		0.2217	
Degrees Lender																											0.4909	***	0.4909	***
																											0.0184		0.0184	
Degrees Borrower																											0.4934	***	0.4934	***
																											0.0182		0.0182	
Cluster Lender																											-0.1405	***	-0.1405	***
																											0.0341		0.0341	
Cluster Borrower																											-0.1132	***	-0.1132	***
																											0.0384		0.0384	
Capital Lender																													-2.7490	***
																													0.3389	
Capital Borrower																													-0.2802	***
																													0.0429	
N	2,100		2,100		1,397		1,160		2,100		2,100		2,048		2,048		2,048		2,048		2,048		2,048		2,048		2,048		2,048	
R2	0.0236		0.5720		0.5282		0.5376		0.5724		0.5173		0.6157		0.6157		0.6166		0.6157		0.6157		0.6161		0.7968		0.7968		0.7968	
Year Fixed Effects	No		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
City Fixed Effects	No		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	

***, ** and * are significant at 1%, 5% and 10% respectively.

Note: Cluster by distance

Table 4.8.OLS Gravity Estimates for Number of Operations

Dependent Variable: Number of Operations (ln)	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15	
Straight Distance (ln)	-0.3101	***	-0.4259	***	-0.3029	***			-0.5564	***			-0.4106	***	-0.4121	***	-0.4149	***	-0.4135	***	-0.4123	***	-0.4122	***	-0.4121	***	-0.2659	***	-0.2659	***
	0.0173		0.0276		0.0671				0.0975				0.0323		0.0314		0.0315		0.0314		0.0314		0.0314		0.0314		0.0275		0.0275	
Altitude					-0.0077																									
					0.0444																									
Road Distance							-0.2715	***																						
							0.0592																							
Squared Distance									0.0281																					
									0.0200																					
Distance < 7 km											6.9308	***																		
											0.9421																			
Distance < 55 km											5.7319	***																		
											0.9758																			
Distance < 400 km											5.0511	***																		
											0.9884																			
Contiguity													0.1031		0.1068		0.1090		0.1075		0.1069		0.1062		0.1112		0.0418		0.0418	
													0.1986		0.1875		0.1855		0.1859		0.1875		0.1874		0.1870		0.1399		0.1399	
Tie Time													0.0697	***	0.0669	***	0.0644	***	0.0655	***	0.0663	***	0.0669	***	0.0647	***	0.0398	*	0.0398	*
													0.0174		0.0193		0.0194		0.0190		0.0194		0.0194		0.0190		0.0212		0.0212	
GDP Lender (ln)															-0.0157		-0.0088		0.0159		-0.0157		-0.0148		-0.0196		0.0419		0.0419	
															0.0947		0.0978		0.0935		0.0953		0.0945		0.0949		0.0832		0.0832	
GDP Borrower (ln)															-0.0165		-0.0241		-0.0206		-0.0178		-0.0162		-0.0145		-0.0161		-0.0161	
															0.0822		0.0827		0.0822		0.0822		0.0821		0.0828		0.0695		0.0695	
Number of Firms (ln)															0.6524	***	0.6572	***	0.6416	***	0.6539	***	0.6523	***	0.6490	***	0.4687	***	0.4687	***
															0.1403		0.1422		0.1364		0.1400		0.1401		0.1395		0.0882		0.0882	
Assets (ln)															-0.0757	***	-0.0738	***	-0.0767	***	-0.0752	***	-0.0758	***	-0.0740	***	-0.2933	***	-0.2933	***
															0.0218		0.0216		0.0221		0.0218		0.0219		0.0216		0.0376		0.0376	
Population															-0.0342		-0.0431		-0.0139		-0.0358		-0.0341		-0.0314		0.1906		0.1906	
															0.2785		0.2781		0.2741		0.2783		0.2784		0.2776		0.2016		0.2016	
HHI (municipality)																	-0.6520													
																	0.2562													
HHI (*departamento*)																			-2.1951	***										
																			0.7458											
HHI < 7 km																					-0.1277									
																					0.1979									
HHI < 55 km																							0.1129							
																							0.1997							
HHI < 400 km																									-15.3032	**	-0.5874		-0.5874	
																									6.2214		0.6315		0.6315	
Degrees Lender																											0.2374	***	0.2374	***
																											0.0371		0.0371	
Degrees Borrower																											0.0485		0.0485	
																											0.0332		0.0332	
Cluster Lender																											0.1638	**	0.1638	**
																											0.0753		0.0753	
Cluster Borrower																											-0.0333		-0.0333	
																											0.1026		0.1026	
Capital Lender																													-1.2747	
																													1.2859	
Capital Borrower																													0.9138	***
																													0.1593	
N	2,223		2,223		1,489		1,242		2,223		2,223		2,170		2,170		2,170		2,170		2,170		2,170		2,048		2,048		2,048	
R2	0.1632		0.5170		0.5370		0.5587		0.5178		0.5073		0.6422		0.6429		0.6428		0.6422		0.6422		0.6427		0.6979		0.6979		0.6979	
Year Fixed Effects	No		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
City Fixed Effects	No		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	

***, ** and * are significant at 1%, 5% and 10% respectively.

Note: Cluster by distance

Table 4.9. OLS Model and Sensitivity Analysis

	Loans				Number of Operations			
Independent Variables	1		2		3		4	
Straight Distance (ln)	-0.3499	***	-0.3428	***	-0.4470	***	-0.1012	**
	0.0064		0.0088		0.0073		0.0474	
Contiguity	0.0180		0.1205	**	0.0206		0.0704	
	0.0340		0.0599		0.0363		0.0777	
Tie Time	0.0114		0.0096		0.0053		0.0095	
	0.0117		0.0127		0.0111		0.0076	
GDP Lender (ln)			-0.0368				-0.0337	
			0.0358				0.0372	
GDP Borrower (ln)			0.0343				0.0106	
			0.0355				0.0364	
Number of Firms (ln)	0.0834	***	0.0656	***	0.0658	***	0.1476	**
	0.0230		0.0135		0.0254		0.0742	
Assets (ln)	-0.0066		0.0077		-0.0063		-0.0222	***
	0.0081		0.0106		0.0077		0.0082	
Population	-0.9240	***	-0.0379	***	-0.9330	***	-0.0182	
	0.0508		0.0067		0.0493		0.0246	
HHI < 400 km	-1.6130		-0.7949	***	-1.5993		-0.6973	***
	0.9905		0.2076		0.9963		0.0695	
Degrees Lender	0.5385	***	0.3823	***	0.5525	***	0.3455	***
	0.0352		0.0078		0.0350		0.0487	
Degrees Borrower	0.4519	***	0.5350	***	0.4069	***	0.4400	***
	0.0373		0.0149		0.0384		0.0516	
Cluster Lender	-0.1872	***	-0.1115	**	-0.1787	***	-0.1334	***
	0.0701		0.0440		0.0671		0.0318	
Cluster Borrower	0.0052		-0.1971	***	0.0204		-0.1745	***
	0.0861		0.0319		0.0831		0.0168	
Capital Lender	-0.1422		-1.1098	***	-0.1795		-1.2921	***
	0.3271		0.2122		0.3052		0.2341	
Capital Borrower	-0.1489	*	0.7878	***	-0.0618		1.0471	**
	0.0786		0.2716		0.0721		0.4214	
N	2,048		2,048		2,092		2,092	
R2	0.8958		0.8994		0.8955		0.8990	
Year Fixed Effects	Yes		Yes		Yes		Yes	
City Fixed Effects	Yes		Yes		Yes		Yes	

***, ** and * are significant at 1%, 5% and 10% respectively.

Note: Cluster by distance. Columns 1 and 3 use the equation derived by AvW. Columns 2 and 4 use PPML estimation.

Table 4.10. Distance Elasticity for Interest Rate

Dependent Variable: Interest Rate (ln)	1	2	3	4	5	6	7	8	9	10	11	12
Straight Distance (ln)	0.0031	-0.0218 *	-0.0184		-0.0232 **	-0.0186	-0.0197 *	-0.0185	-0.0187 *	-0.0183	-0.0189 *	-0.0246 *
	0.0088	0.0116	0.0386		0.0116	0.0114	0.0112	0.0113	0.0113	0.0115	0.0114	0.0125
Squared Distance			-0.0007									
			0.0079									
Distance < 7 km				-0.1091								
				0.2334								
Distance < 55 km				-0.1466								
				0.2374								
Distance < 400 km				-0.2100								
				0.2437								
GDP Lender (ln)					-0.0432	-0.0405	-0.0383	-0.0411	-0.0407	-0.0455	-0.0411	-0.0450
					0.0981	0.0971	0.0970	0.0995	0.0962	0.0964	0.0973	0.0951
GDP Borrower (ln)					0.2121 **	0.2073 *	0.2050 *	0.2074 *	0.2067 *	0.2046 *	0.2072 *	0.2005 *
					0.1079	0.1077	0.1073	0.1078	0.1076	0.1054	0.1070	0.1052
Assets (ln)						-0.0515 ***	-0.0508 ***	-0.0515 ***	-0.0512 ***	-0.0504 ***	-0.0502 ***	-0.0526 ***
						0.0150	0.0151	0.0151	0.0151	0.0150	0.0151	0.0148
HHI (municipality)							-0.2546					
							0.2845					
HHI (*departamento*)								0.0440				
								0.8497				
HHI < 7 km									-0.0948			
									0.2185			
HHI < 55 km										-0.7793 ***		-0.8330 ***
										0.2428		0.2471
HHI < 400 km											-8.2996	
											7.6492	
Degrees Lender												0.0053
												0.0138
Degrees Borrower												0.0305
												0.0234
Cluster Lender												0.3470 *
												0.1809
Cluster Borrower												0.0859
												0.1632
N	2,194	2,194	2,194	2,194	2,143	2,143	2,143	2,143	2,143	2,143	2,143	2,143
R2	0.0000	0.4360	0.4360	0.4360	0.4378	0.4405	0.4408	0.4405	0.4406	0.4438	0.4409	0.4478
Year Fixed Effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City Fixed Effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

***, ** and * are significant at 1%, 5% and 10% respectively.

Note: Cluster by distance

Table 4.11. Capital Structure of the Firm – Leverage

Dependent Variable: Leverage	All firms		Small firms		Medium firms		Large firms	
Distance (Ln)	-0.0705	**	-0.2564	***	-0.1211	**	0.0392	*
	0.0333		0.0459		0.0603		0.0211	
Market size	0.0039	***	-0.0045	*	-0.0031		0.0033	***
	0.0012		0.0027		0.0035		0.0008	
Inverse Mills Ratio	-0.4515		-1.2342		-4.3081		1.3376	
	0.3411		0.3877		4.9748		0.9461	
N	66,178		28,091		12,130		26,011	
R2	0.5157		0.7972		0.8416		0.5232	
Test Instruments Selection Equation	24.6548		25.6363		15.9831		17.0245	
p-value	0.0015		0.0000		0.0000		0.0000	
Year Fixed Effects	Yes		Yes		Yes		Yes	
Industry Fixed Effects	Yes		Yes		Yes		Yes	

***, ** and * are significant at 1%, 5% and 10% respectively.

Table 4.12. Capital Structure of the Firm – Operational Income

Dependent Variable: Operational Income	All firms		Small firms		Medium firms		Large firms	
Distance (Ln)	-0.1116	***	0.1398		-0.0751	***	-0.0686	***
	0.0036		0.1793		0.0080		0.0058	
Market Size	0.0007	***	0.0011	***	0.0006	***	0.0004	***
	0.0001		0.0003		0.0001		0.0001	
Inverse Mills Ratio	-0.0791		-1.1553		0.2965		0.0109	
	0.1766		0.7590		2.7388		0.1319	
N	66,578		28,271		12,193		26,176	
R2	0.8913		0.5531		0.8365		0.5341	
Test Instruments Selection Equation	33.1532		34.6599		28.9580		30.2939	
p-value	0.0000		0.0013		0.0000		0.0000	
Year Fixed Effects	Yes		Yes		Yes		Yes	
Industry Fixed Effects	Yes		Yes		Yes		Yes	

***, ** and * are significant at 1%, 5% and 10% respectively.

Chapter 5

Final Remarks

Financial development is the fuel for access to credit and financial inclusion. Unfortunately, in developing countries, agency problems in banking remain rife, since information asymmetries tend to be high, screening and monitoring costly and creditor rights weak.

This dissertation contributes to the literature about the impact of credit on firm decisions. Particularly, we assess the impact of credit on exporters' decisions and the role of information in credit market on domestic manufacturers. External financing is especially important for exporters for three reasons: First, there are entry costs that are incurred prior to exporting and receiving revenues from export activity. Second, there is a larger delay between production and payment for sales to international markets than domestic sales. Third, there is a higher risk of not being paid for international sales. In this dissertation, we confirm that credit has a positive and significant impact for accessing to export market and provide a more accurate description on the heterogeneous impact at firm size. External financing determines entrance to export market for all firms but its impact vanishes over time for large firms but not for small- and medium- sized firms.

Future research, should consider the impact of trade financing on domestic firms to quantify the impact of credit access on more financing dependent firms. Additional research and depending on available data, may consider other channels of financing, and what channels are more sensitive to international crises.

The dissertation also presents evidence about the importance of pursuing a geographical analysis of credit market as a vehicle to reduce agency problems in local markets. A more accurate recognition of geographical credit markets allows the identification of competition. In our results, we recognize that competition varies across Colombia and, find that information and transaction costs, measured through physical distance, are stronger in geographical areas with less credit-market competition. We also find that information tightens lending at the extensive margin in particular in competitive areas. At firm level,

we find that tightening of lending standards also results in higher loan quality for large firms in high-competition areas. This suggests that a reduction in adverse selection is an important channel through which information affects loan quality.

5.1 Limitations and Future Research

Despite our research contributes to the nascent literature that exploits contract-level information, three caveats emerge. First, we observe borrowers who have credit relationships. We do not know if unobserved firms are not banking, do not meet loan criteria or do not use credit. Unfortunately, information about loan approvals and rejections is not recorded at the national level.

Second, our time window (1998-2006) was a transitioning period for the credit information system. According to financial authorities, all banking institutions must be aligned to Basel II agreements by 2001. Most of the financial institutions met the deadline before 2001 and some others extended their adjustment time during one more year. Basel II implied not only internal adjustments but also changes in the screening criteria. In particular, the definition of collateral changed in terms of what is admissible. Credit score models included more variables in their decisions (i.e. loan amount, loan type, value of collateral, repayment and default history, delay time, and the value of overdue payments) and credit scale changed (i.e. initial scale went from E to A, current scale goes from E to AA). Since we were not able to identify if a particular banking institution was using the *old* or the *new* screening model, we were not able to use some important information as credit scores.

Third, we are able to identify with what banking institution a firm has a credit relation but we are not able to identify the address of a particular bank. We know the city location of the bank and the firm and, based on this we establish the credit relation.

With the considerable volume of new information available more research about information in credit markets is needed. Financial regulators in developing countries are undertaking remarkable efforts to improve information asymmetries in credit market and research at contract-level is limited. Luoto,

McIntosh and Wydick (2007) and de Janvry et al. (2010) analyze the staggered use of a registry by the branches of a Guatemalan microfinance institution. Hertzberg et al. (2011) show how lowering the reporting threshold of the Argentinian credit registry resulted in less lending to firms with multiple lending relationships. Gonzalez-Uribe and Osorio (2014) explore the impact of erasing negative borrower information from a Colombian credit bureau Lastly, Boss et al. (2015) analyze the impact of shared information in Bosnia and Herzegovina.

Exploiting borrower-lender data is important to analyzing the operational distance as we did on this paper but a useful extension may be on the analysis of lender-lender data to analyze functional distance and financial networks and, how these affect market integration within and between countries. Recent research argues that financial integration of banks in a country increases the incidence of systemic banking crises (Caballero, 2015). If this is true, it is valuable to explore the impact of transnational integrations, such as *The Pacific Alliance,* which among other goals, look for the financial integration of Mexico, Colombia, Peru and Chile.

Banking efficiency has been largely explored, but evidence about rational (in)efficiency is scarce (Asmild et al., 2013). This behavior is refers to the firm reducing its productivity levels in order to increase profits. Rational (in)efficiency research would focus on the role of operational and functional distance on (in)efficiency of banking system. For example, overstaffing decisions may be related to reduce functional distance and over branching decisions may emerged as a result of opaque information between lenders and borrowers.

References

Aghion, P., & Bolton, P. (1997). A theory of trickle-down growth and development. *The Review of Economic Studies*, 64(2), 151-172.

Alessandrini, P., Calcagnini, G., & Zazzaro, A. (2008). Asset restructuring strategies in bank acquisitions: Does distance between dealing partners matter? *Journal of Banking & Finance*, 32(5), 699-713.

Alessandrini, P., Croci, M, & Zazzaro, A. (2009). The geography of banking power: the role of functional distance. *The Banks and the Italian Economy*, pp. 93–123.

Alessandrini, P., *Presbitero*, A. F., & Zazzaro, A. (2006). Banks, distances and financing constraints for firms. *Universita Politecnica delle Marche Economics Working Paper*, (266).

Alvarez, R., & López, R. A. (2013). Financial development, exporting and firm heterogeneity in Chile. *Review of World Economics*, 149(1), 183-207.

Amel, D. F., Kennickell, A. B., & Moore, K. B. (2008). Banking market definition: evidence from the survey of consumer finances. *Divisions of Research & Statistics and Monetary Affairs, Federal Reserve Board.*

Amiti, M., & Weinstein, D. (2011). Exports and financial shocks. *The Quarterly Journal of Economics*, 126(4), 1841–1877.

Anderson, J. E., & van Wincoop, E. (2003). Gravity with gravitas: A Solution to the Border Puzzle, *American Economic Review*. March, 93(1), 170.

Arkolakis, C. (2010). Market penetration costs and the new consumers margin in international trade. *Journal of Political Economy*, 118(6), 1151–1199.

Ashcraft, A. (2014). Are Banks Really Special? New evidence from the failure of healthy banks. *The American Economic Review*, 95(5), 1712–1730.

Asmild, M., Bogetoft, P., & Hougaard, J. L. (2013). Rationalising inefficiency: Staff utilisation in branches of a large Canadian bank. *Omega*, *41*(1), 80-87.

Ayyagari, M., Demirgüç-Kunt, A., & Maksimovic, V. (2012). Financing of firms in developing countries: Lessons from research. *World Bank Policy Research Working Paper*, (6036).

Ayyagari, M., Demirgüç-Kunt, A., & Maksimovic, V. (2013). Size and age of establishments: evidence from developing countries. *World Bank Policy Research Working Paper*, (6718).

Ayyagari, M., Demirgüç-Kunt, A., & Maksimovic, V. (2014). Does local financial development matter for firm lifecycle in India? *World Bank Policy Research Working Paper*, (7008).

Banerjee, A. V., & Newman, A. F. (1993). Occupational choice and the process of development. *Journal of political economy*, 274-298.

Barry, C. B., & Brown, S. J. (1985). Differential information and security market equilibrium. *Journal of Financial and Quantitative Analysis*, 20(04), 407-422.

Beck, T., & Demirguc-Kunt, A. (2006). Small and medium-size enterprises: Access to finance as a growth constraint. Journal of Banking & Finance, 30(11), 2931–2943.

Beck, T., Demirgüç-Kunt, A., & Martinez Peria, M. S. (2008). Bank financing for SMEs around the world: Drivers, obstacles, business models, and lending practices. *World Bank Policy Research Working Paper Series*

Beck, T., Demirguc-Kunt, A., Laeven, L., & Levine, R. (2008). Finance, firm size, and growth. *Journal of Money, Credit and Banking*, 40(7), 1379-1405.

Beck, T., Demirgüç-Kunt, A., & Maksimovic, V. (2005). Financial and legal constraints to growth: does firm size matter? *The Journal of Finance*, 60(1), 137-177.

Beck, T., Demirgüç-Kunt, A., & Maksimovic, V. (2006). The determinants of financing obstacles. *Journal of International Money and Finance*, 25(6), 932–952.

Beck, T., Demirgüç-Kunt, A., & Maksimovic, V. (2008). Financing patterns around the world: Are small firms different? *Journal of Financial Economics*, 89(3), 467-487.

Bellone, F., P. Musso, L. Nesta, & S. Schiavo (2010). Financial constraints and firm export behaviour. *The World Economy*, 33(3), 347–373.

Berger, A. N., Demsetz, R. S., & Strahan, P. E. (1999). The consolidation of the financial services industry: Causes, consequences, and implications for the future. *Journal of Banking & Finance*, *23*(2), 135-194.

Berger, A. N., Kashyap, A. K., Scalise, J. M., Gertler, M., & Friedman, B. M. (1995). The transformation of the US banking industry: What a long, strange trip it's been. *Brookings papers on economic activity*, 55-218.

Berger, A. N., Rosen, R. J., & Udell, G. F. (2007). Does market size structure affect competition? The case of small business lending. *Journal of Banking & Finance*, *31*(1), 11-33.

Berger, A. N., & Udell, G. F. (1998). The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle. *Journal of Banking & Finance*, *22*(6), 613-673.

Berger, A. N., & Udell, G. F. (2002). Small business credit availability and relationship lending: The importance of bank organizational structure. *The economic journal*, *112*(477), F32-F53.

Berger, A. N., & Udell, G. F. (2006). A more complete conceptual framework for SME finance. *Journal of Banking & Finance*, 30(11), 2945-2966.

Berger, A. N., & DeYoung, R. (2001). The effects of geographic expansion on bank efficiency. *Journal of Financial Services Research*, *19*(2-3), 163-184.

Berman, N. (2009). Financial crises and international trade: The long way to recovery. Available at http://www.iae.csic.es/investigatorsMaterial/a822215060357763.pdf.

Berman, N., & Hericourt, J. (2010). Financial factors and the margins of trade: Evidence from cross-country firm-level data. *Journal of Development Economics*, 93(2), 206–217.

Bertrand, M., Schoar, A., & Thesmar, D. (2007). Banking deregulation and industry structure: Evidence from the French banking reforms of 1985. *The Journal of Finance*, 62(2), 597-628.

Bolton, P., & Scharfstein, D. S. (1993). Optimal debt structure with multiple creditors (No. 0032). European Science Findation Network in Financial Markets, c/o CEPR, London EC1V 3PZ.

Booth, L., Aivazian, V., Demirguc-Kunt, A., & Maksimovic, V. (2001). Capital structures in developing countries. *Journal of Finance*, 87-130.

Bourgain, A. & Pieretti, P. (2006). Measuring agglomeration forces in a financial center. *Economics Bulletin*, Vol. 18, No. 3 pp. 1-9.

Borgatti, S. P., & Halgin, D. S. (2011). Analyzing affiliation networks. *The Sage handbook of social network analysis*, 417-433.

Bos, J. W., Contreras, M. G., & Kleimeier, S. (2013). The evolution of the global corporate loan market: A network approach. *35th DRUID Celebration Conference*, Barcelona, Spain.

Braun, M. (2005). Financial contractability and asset hardness. Available at *SSRN 2522890*.

Braun, M., & B. Larrain (2005). Finance and the business cycle: International, inter-industry evidence. *Journal of Finance*, LX(3), 1097–1128.

Brevoort, K. P., & Wolken, J. D. (2009). Does distance matter in banking? *The Changing Geography of Banking and Finance*, pp. 27–56.

Broecker, T. (1990). Credit-worthiness tests and interbank competition. *Econometrica: Journal of the Econometric Society*, 429-452.

Caballero, J. (2015). Banking crises and financial integration: Insights from networks science. *Journal of International Financial Markets, Institutions and Money*, *34*, 127-146.

Carling, K., & Lundberg, S. (2005). Asymmetric information and distance: an empirical assessment of geographical credit rationing. *Journal of Economics and Business*, 57(1), 39-59.

Carpenter, R., & Petersen, B. (2002). Is the growth of small firms con- strained by internal finance ? *The Review of Economics and Statistics*, 84(2), 298–309.

Castagnino, T., D'amato, L. & Sangiacomo, M. (2013). How do firms in Argentina get financing to export? Available at https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1601.pdf.

Catini, R., Karamshuk, D., Penner, O., & Riccaboni, M. (2015). Identifying geographic clusters: A network analytic approach. *Research Policy*, 44(9), 1749-1762.

CCIT and FEDESARROLLO (2015). El uso de los medios de pago electrónicos en Colombia Available at http://www.ccit.org.co/index.php/noticias/item/informe-tic-2015

Cerqueiro, G., Degryse, H., & Ongena, S. (2009). Distance, bank organizational structure and credit. *The Changing Geography of Banking and Finance*, 54-74.

Chaney, T. (2013). Liquidity constrained exporters (No. w19170). *National Bureau of Economic Research*.

Chiappori, P.-A., Perez-Castrillo, D., & Verdier, T. (1995). Spatial competition in the banking system: Localization, cross subsidies and the regulation of deposit rates. *European Economic Review*, 39(5), 889–918.

Chor, D., & Manova, K. (2012). Off the cliff and back? Credit conditions and international trade during the Global Financial Crisis. Journal of International Economics, 87(1), 117–133.

De Janvry, A., McIntosh, C., & Sadoulet, E. (2010). The supply-and demand-side impacts of credit market information. *Journal of development Economics*, *93*(2), 173-188.

Dehejia, R., & Lleras-Muney, A. (2007). Financial development and pathways of growth: state branching and deposit insurance laws in the United States, 1900-1940. *Journal of Law and Economics*, *50*(2), 239.

Dell'ariccia, G., E. Detragiache, & R. Rajan (2008). The real effect of banking crises. *Journal of Financial Intermediation*, 17(1), 89–112.

Degryse, H., & Ongena, S. (2004). The impact of technology and regulation on the geographical scope of banking. *Oxford Review of Economic Policy*, 20(4), 571-590.

Demigurc-Kunt, A., & Maksimovic, V. (1996). Stock market development and firm financing choice. *World Bank Economic Review*, 10.

Djankov, S., Freund, C. & Pham, C. (2010). Trading on time. *The Review of Economics and Statistics*, 92(1), 166–173.

DeYoung, R., Goldberg, L. G., & White, L. J. (1999). Youth, adolescence, and maturity of banks: Credit availability to small business in an era of banking consolidation. *Journal of Banking & Finance*, *23*(2), 463-492.

Diamond, D. W. (1991). Monitoring and reputation: The choice between bank loans and directly placed debt. *Journal of political Economy*, 689-721.

Eaton, J., Eslava, M., Kugler, M., & Tybout, J. (2007). *Export dynamics in Colombia: Firm-level evidence* (No. w13531). National Bureau of Economic Research.

Elliehausen, G. E., & Wolken, J. D. (1997). Banking markets and the use of financial services by small and medium-sized businesses. *Journal of Reprints for Antitrust Law & Economics.*, 27, 289.

Elzinga, K. G., & Hogarty, T. F. (1978). Problem of geographic market delineation revisited: The case of coal, The *Antitrust Bull.*, *23*, 1.

Feenstra, R. C. (2003). Advanced international trade: theory and evidence. Princeton University Press.

Feenstra, R. C., Li, Z., & Yu, M. (2014). Exports and credit constraints under incomplete information: Theory and evidence from China. *Review of Economics and Statistics*, *96*(4), 729-744.

Fisman, R., & I. Love (2003). Trade credit, financial intermediary development and industry growth. *The Journal of Finance*, LVIII(1), 353–374.

Formai, S. (2013). Heterogenous firms and credit frictions: a general equilibrium analysis of market entry decisions. *Bank of Italy Temi di Discussione (Working Paper)* No, 940.

Freund, C., & Pierola, M. D. (2015). Export superstars. *Review of Economics and Statistics*, 97(5), 1023-1032.

Galor, O., & Zeira, J. (1993). Income distribution and macroeconomics. *The review of economic studies*, 60(1), 35-52.

González-Uribe, J., & Osorio, D. (2014). Information sharing and credit outcomes: Evidence from a natural experiment. Available at http://juanitagonzalez-uribe.com/wp-content/uploads/2014/10/Gonzalez-Uribe_Osorio_NBER.pdf.

Greenaway, D., Guariglia, A. & Kneller, R. (2007). Financial factors and exporting decisions. *Journal of International Economics*, 73, 377 – 395.

Guiso, L., P. Sapienza, & L. Zingales (2004). Does local financial development matter? *The Quarterly Journal of Economics*, 119(3), 929–969.

Guiso, L., P. Sapienza, & L. Zingales (2004). The role of social capital in financial development *The American Economic Review*, Vol. 94, No. 3, pp. 526-556.

Gourieroux, C., Monfort, A., & Trognon, A. (1984). Pseudo maximum likelihood methods: Theory. *Econometrica: Journal of the Econometric Society*, 681-700.

Harris, M., & Raviv, A. (1990). Capital structure and the informational role of debt. *Journal of finance*, 321-349.

Hauswald, R., & Marquez, R. (2006). Competition and strategic information acquisition in credit markets. *Review of Financial Studies*, *19*(3), 967-1000.

Head, K., Ries, J., & Swenson, D. (1995). Agglomeration benefits and location choice: Evidence from Japanese manufacturing investments in the United States. *Journal of international economics*, *38*(3), 223-247.

Helpman, E., Melitz, M. & Rubinstein, Y. (2008). Estimating trade flows: Trading partners and trading volumes. *Quarterly Journal of Economics*, 123, 441-487.

Hertzberg, A., Liberti, J., & Paravisini, D. (2011). Public information and coordination: evidence from a credit registry expansion. *The Journal of Finance*, *66*(2), 379-412.

Ho, K., & Ishii, J. (2011). Location and competition in retail banking. *International Journal of Industrial Organization*, 29(5), 537–546.

Horowitz, I. (1981). Market definition in antitrust analysis: a regression-based approach. *Southern Economic Journal*, 1-16.

Hummels, D. (2007). Transportation costs and international trade in the second era of globalization. *The Journal of Economic Perspectives*, 131-154.

Jayaratne, J., & Strahan, P. E. (1996). The finance-growth nexus: Evidence from bank branch deregulation. *The Quarterly Journal of Economics*, 639-670.

Jappelli, T., & Pagano, M. (2002). Information sharing, lending and defaults: Cross-country evidence. *Journal of Banking & Finance*, 26(10), 2017-2045.

Jayaratne, J., & Wolken, J. (1999). How important are small banks to small business lending?: New evidence from a survey of small firms. *Journal of Banking & Finance*, *23*(2), 427-458.

Kauper, T. E. (1996). Problem of market definition under EC competition law, *The Fordham International Law Journal*, *20*, 1682.

Kaserman, D. L., & Zeisel, H. (1996). Market definition: implementing the Department of Justice merger guidelines. *Antitrust Bull.*, *41*, 665.

Keeton, W. R. (1995). Multi-office bank lending to small businesses: Some new evidence. *Federal Reserve Bank of Kansas City Economic Review*, *80*(2), 45-57.

Kroszner, R., Laeven, L. & Klingebiel, D. (2007). Banking crises, financial dependence, and growth. *Journal of Financial Economics*, 84(1), 187–228.

Lacovone, L., & Zavacka, V. (2009). Banking crises and exports: Lessons from the past. *World Bank Policy Research Working Paper Series*

Liang, L., Lin, S., & Li. Y. (2014). How agglomeration in the financial services industry influences economic growth: Evidence from Chinese cities. *Economics Discussion Papers*, No 2014-6, Kiel Institute for the World Economy.

Luoto, J., McIntosh, C., & Wydick, B. (2007). Credit information systems in less developed countries: A test with microfinance in Guatemala. *Economic Development and Cultural Change*, *55*(2), 313-334.

Manova, K. (2013). Credit constraints, heterogeneous firms, and international trade. *The Review of Economic Studies*, 80(2), 711–744.

Magerman, G., De Bruyne, K., & Van Hove, J. (2013). Revealed multilateral trade resistance in gravity models – A network approach. *The World Economy*.

Massey, P. (2000). Market definition and market power in competition analysis: some practical issues. *Economic and Social Review*, 31(4), 309-328.

Merton, R. C. (1987). A simple model of capital market equilibrium with incomplete information. *The Journal of Finance*, *42*(3), 483-510.

Minetti, R., & Zhu, S. (2011). Credit constraints and firm export: Microeconomic evidence from Italy. Journal of International Economics, 83(2), 109–125.

Morris, J. R., & Mosteller, G. R. (1991). Defining markets for merger analysis. *Antitrust Bull., 36*, 599.

Muûls, M. (2008). Exporters and credit constraints: A firm-level approach (No. 139). Brussels: National Bank of Belgium.

Novo-Peteiro, J. A. (2009). Bank mergers in spatially differentiated markets. *Journal of Economics and Business*, *61*(1), 90-96.

Opsahl, T., & Panzarasa, P. (2009). Clustering in weighted networks. *Social networks*, *31*(2), 155-163.

Paravisini, D., Rappoport, V., Schnabl, P., & Wolfenzon, D. (2015). Dissecting the effect of credit supply on trade: Evidence from matched credit-export data. *The Review of Economic Studies*, *82*(1), 333-359.

Park, K., & Pennacchi, G. (2009). Harming depositors and helping borrowers: The disparate impact of bank consolidation. *Review of Financial Studies*, *22*(1), 1-40.

Peek, J., & Rosengren, E. (1997). The international transmission of financial shocks: The case of Japan. *The American Economic Review*, 87(4), 495–505.

Peek, J., & Rosengren, E. (2000). Collateral damage: Effects of the Japanese bank crisis on real activity in the United States. *The American Economic Review*, 90(1), 30–45.

Peek, J., & Rosengren, E. (2005). Unnatural selection: Perverse incentives and the misallocation of credit in Japan. *The American Economic Review*, 95(4), 1144–1166.

Petersen, M. A., & Rajan, R. G. (1995). The effect of credit market competition on lending relationships. *The Quarterly Journal of Economics*, 407-443.

Petersen, M. A., & Rajan, R. G. (1997). Trade credit: Theories and evidence. *The Review of Financial Studies*, 10(3), 661–691.

Petersen, M. A., & Rajan, R. G. (2002). The information revolution and small business lending: Does distance still matter? *Journal of Finance*, *57*(6), 2533-2570.

Pita-Barros, P. (1999). Multimarket competition in banking, with an example from the Portuguese market. *International Journal of Industrial Organization*, 17(3), 335–352.

Presbitero, A. F., & Rabellotti, R. (2014). Geographical distance and moral hazard in microcredit: evidence from Colombia. *Journal of International Development*, *26*(1), 91-108.

Rajan, R. G. (1992). Insiders and outsiders: The choice between informed and arm's-length debt. *The Journal of Finance*, *47*(4), 1367-1400.

Rajan, R., & Zingales, L. (1998). Financial dependence and growth. *American Economic Review*, 88(3), 559–586.

Rigobon, R., & Stoker, T. M. (2007). Estimation with censored regressors: Basic issues. *International Economic Review*, *48*(4), 1441-1467.

Rozenfeld, H. D., Rybski, D., Andrade, J. S., Batty, M., Stanley, H. E., & Makse, H. A. (2008). Laws of population growth. *Proceedings of the National Academy of Sciences*, 105(48), 18702-18707.

Sanchez, F., & J. Nunez (2000). La geografía y el desarrollo económico en Colombia: una aproximación municipal" *Desarrollo y Sociedad*, 46, 43–98.

Sapienza, P. (2002). The effects of banking mergers on loan contracts. *The Journal of finance*, *57*(1), 329-367.

Schiffer, M., & Weder, B. (2001). *Firm size and the business environment: Worldwide survey results* (Vol. 43). World Bank Publications.

Silva, J. S., & Tenreyro, S. (2006). The log of gravity. *The Review of Economics and statistics*, *88*(4), 641-658.

Shrieves, R. E. (1978). Geographic market areas and market structure in the bituminous coal industry. *Antitrust Bull.*, *23*, 589.

Simons, J. J., & Williams, M. A. (1993). Renaissance of market definition, The *Antitrust Bull.*, *38*, 799.

Slade, M. E. (1986). Exogeneity tests of market boundaries applied to petroleum products. *The Journal of Industrial Economics*, 291-303.

Stigler, G. J., & Sherwin, R. A. (1985). The extent of the market. *Journal of Law and Economics*, 555-585.

Stiglitz, J. E., & Weiss, A. (1981). Credit rationing in markets with imperfect information. *The American economic review*, 393-410.

Stein, J. C. (2000). Information production and capital allocation: Decentralized vs. hierarchical firms (No. w7705). *National Bureau of Economic Research*.

Stock, J., Wright, J. & Yogo, M. (2002). A Survey of weak instruments and weak identification in generalized method of moments. *Journal of Business & Economic Statistics*, 20(4), 518–529.

Strahan, P. E., & Weston, J. P. (1998). Small business lending and the changing structure of the banking industry. *Journal of Banking & Finance*, 22(6), 821-845.

Sussman, O., & Zeira, J. (1995). Banking and development. Center for Economic Policy Research. Available at http://cepr.org/active/publications/discussion_papers/dp.php?dpno=1127

Udell, G. F. (1989). Loan quality, commercial loan review and loan officer contracting. *Journal of Banking & Finance*, *13*(3), 367-382.

Weston, J., & Strahan, P. E. (1996). Small business lending and bank consolidation: Is there cause for concern? *Current issues in Economics and Finance*, 2(3).

Werden, G. J. (1992). Four suggestions on market delineation. *Antitrust Bull.*, *37*, 107.

Werden, G. J. (1998). Demand elasticities in antitrust analysis. *Antitrust Law Journal*, 363-414.

World Bank (2015) Colombia - Systematic country diagnostic. *World Bank Group*. Available at http://documents.worldbank.org/curated/en/2015/07/24742430/colombia-systematic-country-diagnostic

Wooldridge, J. (2002). Econometric analysis of cross section and panel data. The MIT Press, London, England, 2002 edn.

Zardkoohi, A., & Fraser, D. R. (1998). Geographical deregulation and competition in US banking markets. *Financial Review*, 33(2), 85–98.

Appendix. Network Variables

The network in a city is represented by $G = (N, A, W)$. Cities are represented by $n \in N$ nodes in the network. The existence of direct flows between nodes are given by edges between those nodes ($a_{ij} \in A$), where i is the lender city and j is the borrower city. The complete collection of all cities (nodes) and aggregate credit volumes (edges) is called *network*. A is the $n \times n$ binary adjacency matrix with entries with the following possibilities: 1) $a_{ij} = 1\ if\ V_{ij} > 0$ and, 2) $a_{ij} = 0$ otherwise.

We also construct the weighted adjacency matrix similar to Newman (2010), and Bruyne, Magerman and van Hove (2013). The weights of the edges $w_{ij} \in W$ are represented by the value of the credits or the number of operations so, $V_{ij} = a_{ij}w_{ij}$. As there are cities with no banks, we do not impose symmetry in our adjacency matrix.

To reveal the outward multilateral resistance variable We use the out-degree of a lender, and similar for the inward multilateral resistance term We use the in-degree of a borrower. The weighted out-degree d_i^{out} of node i is given by $d_i^{out} = \sum_j V_{ij}$ (weighted number of active credit destinations) and the in-degree d_j^{in} of node j is given by $d_j^{in} = \sum_i V_{ij}$ (weighted number of credit origins).

The local clustering coefficient C_{ij} of node i measures the fraction of a node's neighbors that are themselves connected. Meaning, the clustering coefficient states the expected or average probability that a pair of i's partners is itself a pair: given that a_{ij} and a_{ik} exist, C_{ij} denotes the probability of a_{ij}. More formally (Jackson, 2008):

$$C_i = \frac{\sum_{j \neq i, k \neq i, k \neq j} a_{ij} a_{jk} a_{ik}}{\sum_{j \neq i, k \neq i, k \neq j} a_{ij} a_{ik}}$$

The denominator of the right hand side of the equation sums over the triples i, j, k where a_{ij} and a_{ik} are equal to 1 (active links). The numerator then sums over the existing transitive triples. It is clear that $C_{ij} \in (0,1)$ and furthermore that $C_{ij} = 1$ if and only if all possible transitive triples are present that emanate from node i.

Vita - Monica Roa

Education

Dual-PhD Agricultural, Environmental and Regional Economcis & Operations Research
The Pennsylvania State University, 2016
M. A. in Economics
Universidad de los Andes, 2006
B.A. in Economics
Universidad de los Andes, 2004

Relevant Positions Held

Graduate Research Assistant Agricultural Economics, Sociology, and Education The Pennsylvania State University, United States	2010 – Present
Research Assistant FADNTOOL Project Wageningen University, The Netherlands	2013 – 2014
Subdirector of Macroeconomic Studies Economic Studies Office National Department of Planning, Colombia	2008 - 2010

Teaching Experience

Instructor of Economic Measurement Universidad de los Andes, Colombia	2010
Instructor International Economics Policy Universidad del Rosario, Colombia	2007 -2008
Teaching Assistant, International Economics Universidad de los Andes, Colombia	2002 - 2008

Journals

1. "Country risk ratings and financial crises 1990-2001: a survival analysis" (2009). (with Leonardo Bonilla and Andrés García) Review of Business 30 (1), 33-45.
2. "Estructura salarial y segmentación en el mercado laboral de Colombia: un análisis de las siete principales ciudades, 2001-2005" (2008) (with Diana Mesa and Andrés García) Borradores de Economía No. 52. Universidad del Rosario
3. "¿Migran los colombianos para mejorar sus condiciones laborales? Evidencia de la hipótesis de selección" (2008) Revista Planeacion y Desarrollo Vol. 27 (4), 48-66. Departmento Nacional de Planeacion

Working Papers

1. "The effect of credit on the export performance of Colombian exporters" (2014) (with Danielken Molina) IDB Working Paper Series No. IDB-WP-507
2. "A stochastic simulation framework that is capable of simulating the impacts of policy measures on in" (2014) with Alfons Oude Lansink (Wageningen University) and Spiro Stefanou (Pennsylvania State University)
3. "Simulation results addressing the impacts of policy measures on input demand" (2014) with Alfons Oude Lansink (Wageningen University) and Spiro Stefanou (Pennsylvania State University)