MONICA ROA RODRIGUEZ
+1 (814) 777-5269 Mobile
monicaproa@gmail.com

EDUCATION

PhD Applied Economics & Operations Research, Pennsylvania State University 2016
M. A. in Economics, Universidad de los Andes 2006
B.A. in Economics, Universidad de los Andes 2004

FIELDS OF INTEREST: Microeconomics, Development Economics, Applied Banking, Credit Market, Big Data Analysis, Causal Inference, Microsimulation, Applied Econometrics

LANGUAGES: Spanish (native), English (bilingual proficiency), French (professional working proficiency)

COMPUTER SKILLS: STATA (Advanced), MATLAB (Advanced), R (Advanced), GAMS (Basic), SQL (Basic), GIS (Basic), Python (Certified by University of Michigan)

RELEVANT POSITIONS HELD

Data Scientist/Economist 2016 – Present
Twnel Inc. Part time
Boston, United States

- Develop causal inference models to analyze the infrastructure of small- and medium-sized firms in emerging economies to improve their supply chain
- Develop econometric models to estimate, monitor and visualize the efficiency of firms registered at Twnel Inc.

Research Economist 2016 – Present
Central Bank of Mexico Full time
Mexico City, Mexico

- Assist the Chief Economist of the Central Bank of Mexico in analyzing the economics of regulatory issues and proposals related with banking regulation, supply value chain and migration
- Identify bottlenecks in banking in Colombia and Mexico, and formulates research to address those issues
- Generate econometric and statistical tools and analysis that provided support for general policymaking design. My work is both data- and method-intensive.

Research Assistant, Professor Spiro Stefanou 2010 – 2016
Agricultural Economics, Sociology, and Education Full time
Pennsylvania State University, United States

- Analyze and process bank level data from Colombia to develop a theoretical and econometric model to assess efficiency of the banking sector
- Match firm and bank level data from Colombia to analyze with an empirical model the impact of credit constraints on exporters performance

Research Assistant, Professor Hoyt Bleakley 2005 - 2016
Department of Economics Part time
University of Michigan, United States

- Analyze and process bank data at city level in Colombia to construct a model able to redefine credit market based on loan flows and analyze the causality between access to credit and firm's performance

- Assemble from archival sources information on the voting for local municipal councils in Colombia to demonstrate the interplay of ballots and bullets in civil conflict as well as how rentseeking destabilizes the electoral process.

Research Assistant FADNTOOL Project 2013 – 2014
Wageningen University, The Netherlands Full time

- Analyze farmer accounting data from 29 European countries
- Construct a stochastic microsimulation model capable to assess the impact of agricultural policies on the demand of agricultural inputs, supply of agricultural products and income of farmers from 29 European countries.
- Communicate the scope of the model to policy makers from The European Commission

Research Assistant, Professor Alessandro Bonanno 2012
Agricultural Economics, Sociology, and Education Part time
Pennsylvania State University, United States

- Process scanner data to a analyze consumer's food patterns in the USA

Subdirector of Macroeconomic Studies 2008 - 2010
Economic Studies Office Full time
National Department of Planning, Colombia

- Conduct research on financial and labor economics to answer policy questions related with financial risk management, bank efficiency, family composition, retirement plans, wage regional gaps and migration. The tasks involved the processing of household surveys and banking data, their analysis and, construction of economic and econometric models.
- Coordinate the quarterly reports about Colombia's economy. It involved the follow up and forecast of macroeconomic indicators (monetary policy, labor, agricultural, transport and trade indicators)
- Participate in meetings with Colombian policy makers to design and follow up policies
- Analyze of household and manufacturing surveys from Colombia to elaborate the above-mentioned reports.

Research Assistant, Professor Juan Carlos Guataqui 2007 - 2008
Department of Economics Full time
Universidad Nuestra Señora del Rosario, Colombia

- Process and analyze Colombian household surveys to construct an econometric model able to analyze wage regional differences
- Process and analyze census data to evaluate the quality of migration module of the Colombian Population Census

Transfer Pricing Analyst 2007
PricewaterhouseCoopers, Colombia Full time

- Conduct research and documentation of banks
- Develop solutions for banks

Risk Analyst 2005 - 2007
Bancoldex, Colombia Full time

- Create a multi-criteria model aimed at analyzing the performance of commercial borrowers sorted across economic sectors.
- Provide methodological, statistical and econometric support in the design of the credit risk software.
- Participate in the development and implementation of the market risk model providing statistical and econometric support.

TEACHING EXPERIENCE

Instructor of Economic Measurement 2010
Universidad de los Andes, Colombia

Instructor International Economics Policy 2007 -2008
Universidad del Rosario, Colombia

Teaching Assistant, International Economics 2002 - 2008
Universidad de los Andes, Colombia

PROFESSIONAL PRESENTATIONS

Finance and Economics Conference, Frankfurt, Germany 2015
Seminar Banco de Mexico, Mexico City, Mexico 2015
Annual Bank Conference on Development Economics, Mexico City, Mexico 2015
Midwest Economic Theory and International Trade Meetings, Columbus, USA 2015
Latin American and Caribbean Economic Association 19th, Sao Paulo, Brazil 2014
European Regional Science Association 54th, St. Petersburg, Russia 2014
North American Productivity Workshop VIII, Ottawa, Canada 2014
Financial Services Institute Symposium, St. John's University, New York, USA 2009
Latin American and Caribbean Economic Association), Rio de Janeiro, Brazil 2008

AWARDS

Jose de La Torre Award, Pennsylvania State University 2015

JOURNALS

"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.

"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

"¿Migran los colombianos para mejorar sus condiciones laborales? Evidencia de la hipótesis de selección" (2008) Revista Planeacion y Desarrollo Vol. 27 (4), 48-66. Departamento Nacional de Planeacion

WORKING PAPERS

"The effect of credit on the export performance of Colombian exporters" (2014) (with Danielken Molina) IDB Working Paper Series No. IDB-WP-507

"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)

"Simulation results addressing the impacts of policy measures on input demand" (2014) with Alfons Oude Lansink (Wageningen University) and Spiro Stefanou (Pennsylvania State University)

WORK IN PROGRESS

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

"Long-Term Impacts of La Violencia in Colombia" with Hoyt Bleakley, Department of Economics, University of Michigan

"Understanding the impact of dynamic provisions on credit perfomance in Colombia" with Bernardo Morais, Board of Governors, Federal Reserve System

REFERENCES

Hoyt Bleakley
Associate Professor - Economics
University of Michigan
Phone: +1 (734) 763-9237
Email: hoytb@umich.edu

Spiro Stefanou
Emeritus Professor - Applied Economics
Pennsylvania State University
Phone: +1 (352) 294-7625
Email: sstefanou@ufl.edu

Alfons Oude Lansink
Director of School of Social Sciences
Wageningen University
Phone: +31(0) 317485194
Email: alfons.oudelansink@wur.nl

Danielken Molina
Research Analyst
California Department of Finance
Phone: +1 (202) 623-3778
Email: danielkenm@gmail.com

To the Members of the Recruitment Committee
National Bureau of Economic Research

I am writing to express my interest in the position as Postdoctoral Fellow in the in the NBER's Entrepreneurship Working Group. I received my PhD in Applied Economics and Operations Research from The Pennsylvania State University in 2016 and I will be at the ASSA/AEA meeting in January. I am passionate about the intersection between development and finance, particularly in analyzing the impact of credit on firm's performance. In my research I have used data techniques in large and complex data sets to answer questions that gravitate towards credit constraints at micro level. I am interested in continue analyzing the intersection between financing and entrepreneurship in the context of FinTech. Particularly, I am interested in analyzing how the supply chain of small and medium sized firms can be improved though the use of FinTech. I believe that my knowledge and interests significantly align with the profile of a successful Postdoctoral Fellow in the National Bureau of Economic Research.

Currently, I am researcher at The Central Bank of Mexico and data scientist at Twnel Inc., a startup located in Boston. All the projects I partake in involve big data management and economic modelling. Currently I am doing the revisions to publish one paper in which with Danielken Molina (California Department of Finance), we evaluate the impact of credit constraints on the performance of exporters and non-exporters. In undertaking this project, we have to construct a single dataset by linking three datasets from different sources: transactional customs data, balance sheets data, and bank-firm matched data. Given the differences of the identifier in each data set we develop an algorithm to merge the three datasets. We found 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.

In a second paper, I propose a model to analyze the impact of geographical distance between borrowers and lenders on firm's performance. Here, I use the bank-firm matched data, the balance sheets of firms and banks and, the geographical information of firms. One of the biggest challenges of this paper is the creation of an algorithm to find the closest bank to each borrower-firm. After finding the closest bank, I analyze the geographic definition of credit markets based on cluster analysis and market segmentation. The novelties of the paper are: i) to define the market based on credit flows, and ii) to estimate the impact of the market size on borrower´s performance. In the initial version of the paper I use Bubble Cluster Algorithm, and currently, I am comparing the results with a City Cluster Algorithm. I found that credit markets are defined at a local level, and high transactional and information costs -represented by geographical distance- tightens lending at the intensive and extensive margin in competitive markets especially for firms with poor collateral (i.e. small firms).

My interests are not limited to finance but to other topics where I can take advantage of complex data. For instance, in other paper on progress, jointly with Hoyt Bleakley (University of Michigan), we use regression discontinuity analysis to evaluate the relation between violence and political parties in Colombia. In this paper we track the elections at municipal level from 1948 to 1956, and to merge the data we use a string matching algorithm to create a single dataset. In some preliminary conclusions we found that elections in 1945 and 1947 were severely manipulated before the assassin of the main presidential candidate in 1948.

I am also working with Bernardo Morais (Board of Governors of The Federal Reserve System) on proposing an estimator of the production function of manufacturing firms based on a weighting of the in-sample and predict the performance of actual application datasets.

In my work as data scientist for Twnel Inc.[1], I analyze the supply chain of small and medium sized firms to predict clusters around the companies that they interact with and suggest alternative business given the existing infrastructure of the companies.

My interest on big data emerged from my M.A. in Economics. I had my first contact with big data when I was doing my thesis and I had to use Population Census to analyze the impact of internal migration on labor markets in Colombia. After I finished my M.A., I worked as Risk Analyst at Bancoldex (the public-private development bank in Colombia) where I had to analyze all the credit relationships of the bank to create a model able to classify and predict the riskier borrowers. When I was doing my PhD I worked with big data of financial transactions and scanner data. In addition, when I moved to Netherlands to work for the European Commission, I developed a microsimulation model using the farm census.

Given my interests and experience in finance, entrepreneurship and big data, the project I would like to develop in the NBER, is analyzing the impact of credit constraints on the supply chain of small and medium sized firms in an emerging economy. One of the biggest challenges a small firm has is related with credit access. The lack of financial literacy joined with the high costs of financial services make that around 90% of the financial transaction are made in cash (World Bank, 2015). On one hand, financial illiteracy of small firms is reflected on four facts: i) firms are not aware of the requirements to meet a loan (e.g. they don´t keep track of their activities), ii) firms do not know other channels to finance their activities (e.g. factoring among others), iii) they lack a property structure of corporate governance, and iv) the high indebtedness (i.e. the lack of knowledge of the conditions of the loan, might create a mismatch of payment´s schedule).

[1] Twnel Inc. is an start-up that developed an application in which the companies can communicate with their supply chain.

On the other hand, the high costs of credit include not only the interest rate but also the study of the borrower and the cost of the collateral. First, the interest rates reflects asymmetric information and moral hazard. For instance, a first time borrower might be seen as highly risky for a financial institution and the high interest rate reflects the risk profile. Second, the cost of studying a potential borrower. A financial institution charges a fee between 1% - 4% over the loan to study a potential borrower. The differences on the fees depend on how easy is to analyze the risk profile. For instance, some firms do not keep record of their activities, and other store the information in soft way2. The problem is that collecting soft information is a personal process and the verification, transmission, and storing of such information tends to be quite difficult (Stein, 2000), especially if the distance between lender and borrower is important (Roa, 2016). The third additional cost, the borrower must consider is the cost of the collateral. The collateral or guarantee facilitates the approval of a loan, but the cost is high. In the particular case of Colombia, borrowers must pay an additional fee of 2.8% for a guarantee that backs a loan of US5,500.

Considering the above mentioned problems, the governments and financial institutions are exploring new channels through which credit access for small and medium sized firms might be easier. One of the new channels is FinTech. This alternative takes advantage of big data to provide access to credits. For instance, financial institutions use information of the payments of utility bills to construct a credit history of the potential borrower. Other use of FinTech is observed in mobile applications that work as social network for firms. So far, seven countries from Latin America are using such platforms: Panamá, Costa Rica, Guatemala, El Salvador, Nicaragua and Honduras. These platforms store information of small and medium sized firms and their suppliers, therefore, it is possible to track the full supply chain. The project I would like to develop during my appointment at the Watson Institute, would use the data of the social network for firms jointly with the credit reports of the firms and their suppliers. On one hand, the social network provides a granular description of the supply chain of the firm and the suppliers. Then, it is possible to identify shared suppliers and the differences in the organization of the supply chain among industries. On the other hand, the credit report allows the identification of the credit characteristics of the firm and their suppliers.

The theoretical approach to analyze the impact of credit constraints on vertical relations is recent (Nocke and Thanassoulis, 2014), and the empirical evidence focus on the intersection between risk management and product market strategies (Kaufmann and Lafontaine, 1994) or the impact of credit constraints on the global value chain (Manova and Yu, 2013; Das et al., 2014). The purpose of the research is to take advantage of the new data available in Twnel Inc., and analyze the impact credit constraints have on

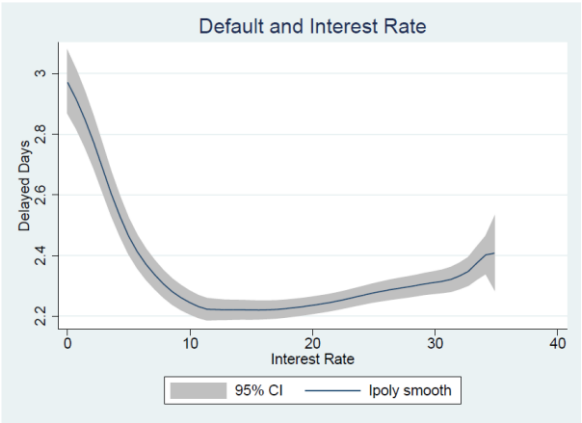
[2] Soft information is the one that is difficult to communicate (i.e. incomplete balance sheets store only in paper)

firms' structure with their partners in the supply chain; and test how imperfect capital markets can alter short run prices along the supply chain[3].

The first paper of the project would analyze how the terms of the contract between borrower and lender alter the default of the borrower in line with the Supply Chain Finance theory (SCF). Pfohl and Gomm show that SCF turns the actors within the supply chain into intermediaries who can partly overcome the problem of asymmetric information between financial intermediaries and the parties seeking capital. The purpose of the model is to use the data of the companies registered in Twnel Inc., and develop a model to test under which conditions SCF is profitable for both sides. Moreover, the model would show under which circumstances an additional transfer of information is profitable and when not.

It has been told that riskier borrowers face higher interest rates (Cho, 1986), but high interest rates can also trigger the default rate. Figure 1, shows the relationship between the default (measured as the delayed days on a payment) and the interest rate; and Figure 2, shows the relation between the credit score and the interest rate. Both figures show a U relationship between default and interest rates, then in the first paper I would like to explore what terms of the credit contract trigger default and how is the transmission through the supply chain of the firms.

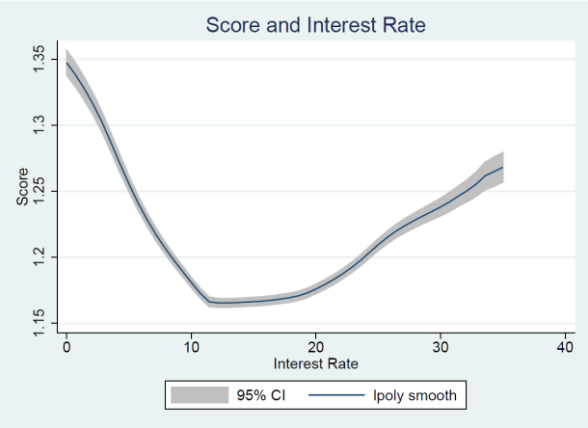
Figure 1. Default and Interest Rate



Source: Superintendencia Financiera de Colombia. Own calculations

[3] Nocke and Thanassoulis (2014) find that credit constrained firms are endogenously risk averse and so seek to push some risk onto suppliers.

Figure 2. Score and Interest Rate



Source: Superintendencia Financiera de Colombia. Own calculations

As I mentioned before, the current data allows to identify how the suppliers are connected with other firms then, we can consider the multiple relations between firms and suppliers as a network. Then, in the second paper I would like to analyze how the transmission of the default works once the main nodes of the network do not meet the payments of the financial obligations.

Finally, and maybe the biggest challenge of the project is to construct a credit score for small and medium-sized firms using the information of the structure of the supply chain. Recent studies (Arráiz, Bruhn, and Stucchi, 2016) propose psychometrics measures as complementary to the credit scores. I propose using the supply chain structure to evaluate id the more integrated is a potential borrower the more productive it is, and therefore less risky. Indeed, global value chain literature has proved that foreign affiliates inserted in global supply chains tend to have larger capabilities in terms of size, skills and productivity, are more export oriented, and produce goods of higher quality than other exporters in the country (Blyde and Santamaria, 2013).

I enjoy working on interdisciplinary projects. My time in academia and work experience has given me leadership skills and exposure with different audiences and cultures in four different countries (i.e. Netherlands, United States, Mexico and Colombia). The experience and skills I have developed make me a strong candidate for the Postdoc position in the National Bureau of Economic Research. Thank you very much for your consideration. I look forward to speaking to you about this opportunity.

Kind regards, Monica Roa

References

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Blyde, J., & Santamaria, J. (2013). The Performance of Plants Inserted in Global Supply Chains: A Look at Vertically-Linked Affiliates.

Lafontaine, F., & Kaufmann, P. J. (1994). The evolution of ownersip patterns in franchise systems. *Journal of Retailing*, *70*(2), 97-113.

Manova, K., & Yu, Z. (2013). *Firms along the value-added Chain: Processing trade in China*. mimeo, Stanford University.

Nocke, V., & Thanassoulis, J. (2014). Vertical relations under credit constraints. *Journal of the European Economic Association*, *12*(2), 337-367.

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Wang, J., & Shu, Y. F. (2005). Fuzzy decision modeling for supply chain management. *Fuzzy Sets and systems*, *150*(1), 107-127.

LSA ECONOMICS
UNIVERSITY OF MICHIGAN

Letter of Recommendation for Monica Roa

November 6, 2016

Dear Sir or Madam,

I am pleased to recommend Monica Roa for a position at your institution. I have come to know Ms. Roa while she has worked with me first as a research assistant and later as a collaborator on several projects using a variety of Colombian data sources. I first got to know her around 2006 and we have worked together off and on since then. During this time, I have had a good opportunity to get to know her abilities and instincts as a researcher. I also served as an external member of her dissertation committee at Penn State. She is currently a Research Economist at the Banco de Mexico (the Mexican central bank), where she is investigating spatial issues in credit markets, among other topics.

Her dissertation consisted of three diverse chapters, all of which use novel combinations of data to consider fundamental questions in the economics of Latin America: spatial aspects of bank-market concentration, credit access and export performance, and civil conflict.

Before describing the papers, let me discuss my personal impressions of Monica Roa as a researcher. I am especially impressed with her resourcefulness. Also, her knowledge of the conceptual and methodological issues pertinent to these projects is excellent. And her ability to work independently is remarkable.

For much of her research, she assembled administrative, firm-level financial information from two government agencies in Colombia, the Superintendencia Financiera and the Superintendencia de Sociedades, which record information on loans and on balance sheets of small and medium firm, respectively. She links these records together to form an unusual database in that it contains balance-sheet information for a large number (circa 9,000) of unlisted non-financial firms. Needless to say, it did not come in an easily managed, user-friendly format, so she had had to wrestle with the data to a certain degree. Monica has proved quite adept at working through these issues, and as well as obtaining whatever information was necessary in the legal, administrative, and accounting frameworks to correctly interpret the variables in the dataset. She has also needed to link these data with auxiliary information from other, often obtusely coded, sources. Again, Monica was instrumental in finding this information and providing the correct interpretation to guide its use.

Flowing from these data-collection efforts, there are various projects and research designs. One paper (joint with Danielken Molina) involves measuring the role of credit access helping/hindering exports by SMEs. In another project, she and I examine firms

most exposed to mergers because they had loans from two banks that merged or were in a local market where the merger had a greater effect of the concentration of credit supply.

In another paper, she uses the firm and loan databases to examine the geography of credit access in Colombia. She analyzes flows of bank credit across space using information at the micro level on the origin and destination municipalities of each loan issued in the past decade (plus). In reduced-form analysis, she shows a large local bias in loan transactions, perhaps not surprisingly, but she also shows significant retail credit linkages across typically narrowly defined local markets. Indeed she documents fairly smooth relationship between loans (measured along intensive or extensive margins) and distance between the firm and the bank. (Of course, for any given firm alone/bank tends to be lumpy, so all of the analysis is based on aggregation to higher levels.) She then uses down a gravity model adapted to the discrete choice aspects of the problem and estimates this on her data of credit flows across municipalities. She shows markets that appear to be quite concentrated at the local level might, when spatial interactions are taken into account, appeared to be quite competitive. As this work is further developed, it will have implications for competition policy in the banking sector, as it provides a methodology for re-defining credit-market competition. I see this work eventually being published in a banking or development journal.

In a series of smaller projects, she and I have collaborated on archival research on Colombian economic history. In one such project, she has reviewed and collated the various estimates of output per capita for each departamento in Colombia. Another project has involved searching for historical data on elections and mayoralties at the municipio level. This has been no small undertaking, but Monica has been more than up to the task. Again, she has done a fantastic job with a minimal amount of direction from me. We are preparing a paper that investigates causes of partisan violence in Colombia's civil war known as La Violencia (circa 1950). The main fighting took place between Colombia's two main political parties, the Conservatives and Liberals. We assembled from archival sources information on the voting for local municipal councils prior to the outbreak of civil conflict. This was complicated by the fact that the national government burned much of its archives at the end of the conflict, but Monica was able to to track down alternate sources. We document a discontinuous relationship between party vote shares and violence at a cutoff that determined which party held a majority on the council. This effect is particularly pronounced in regions with extractive industries. This demonstrates the interplay of ballots and bullets in civil conflict as well as how rent-seeking destabilizes the electoral process.

Prior to her graduate studies, she proved similarly adept in her work at the Colombian government's planning agency (Departamento Nacional de Planeacion), which is one of the Colombian government's leading ministries for economic policy. Before going to

graduate school, she was promoted to subdirector of the economic studies division, another testament to her work ethic and potential in applied economics. More recently, she has been on a team for a larger project for the European Union analyzing policy for the agricultural sector. Unlike some who might be more suited to purely "ivory tower" endeavors, we see that she can also work well on policy-oriented research teams.

Bottom line: Monica Roa shows tenacity and entrepreneurial approach to acquiring and analyzing novel data for interesting research questions. She is developing good instincts as an independent researcher and has also demonstrated the ability to work in research teams. Her dissertation is ample evidence of these qualities. I recommend her highly for policy-sector and other team-oriented research institutions. I also recommend her for academic jobs, outside of the top 30.

Please let me know if you require anything further from me regarding Ms. Roa's candidacy. Until then I remain

Sincerely yours,



Hoyt Bleakley

Associate Professor of Economics
Department of Economics
University of Michigan
hoytb@umich.edu