Innovation and entrepreneurship in Latin America: What do we know? What would we like to know?

Innovación y emprendimiento en América Latina: ¿Qué sabemos?, ¿qué nos gustaría saber?

Roberto Álvarez*
Matteo Grazzi**

Abstract

The long-run economic performance of Latin America has been unsatisfactory especially in comparison with other emerging economies, which have been able to "catch up" with developed countries. The historically low innovation and dynamic entrepreneurship rates have been identified as two of the main reasons for this situation. In this paper, we present a synthetic but comprehensive review of the empirical literature related to these topics in the region, as well as the results of the main impact evaluations performed to assess innovation and entrepreneurship policies implemented in Latin America. This review, together with the identification of unexplored or underexplored areas of research, is functional to introducing the investigations that are part of this special issue.

Key words: *Innovation, entrepreneurship, Latin America.*

JEL Classification: *L26, M13, O31.*

Resumen

El desempeño económico de largo plazo de América Latina ha sido insatisfactorio, especialmente en comparación con otras economías emergentes que han podido lograr alcanzar los niveles de ingreso de los países desarrollados. Las tasas históricamente bajas de innovación y emprendimiento dinámico se han identificado como una de las principales causas de esta situación. En este

* Department of Economics School of Business and Economics University of Chile. E-mail: robalvar@fen.uchile.cl
** Competitiveness and Innovation Division Inter-American Development Bank. E-mail: matteog@iadb.org

Received: Accepted:

artículo presentamos una revisión sintética pero exhaustiva de la literatura empírica relacionada con estos temas en la región, así como de los resultados de las principales evaluaciones de impacto realizadas para evaluar las políticas de innovación y emprendimiento implementadas en América Latina. Esta revisión, junto con la identificación de áreas de investigación no exploradas o solo parcialmente exploradas, sirve para introducir las investigaciones que son parte de este número especial.

Palabras clave: *Innovación, emprendimiento, América Latina*

Clasificación JEL: *L26, M13, O31.*

1. Introduction

In comparison with other regions, the long-run economic growth of Latin America and the Caribbean (LAC) has been unsatisfactory. In the period 1960-2017, the average per capita GDP growth was only 1.76%, less than half than in other emerging regions such as East Asia and the Pacific (3.67%), and less than the figures for developed economies –2.03% in the US, 2.21% in OECD countries– (World Bank Development Indicators, 2018). The consequence is that LAC has not only failed to catch up with, but has also lost ground with respect to other regions.

This disappointing performance is mainly explained by the substantial stagnation of productivity that has been experienced in the region. During the past five decades, while the average total factor productivity (TFP) growth has been almost zero in LAC, in countries such as the United States, China, and Finland, the annual TFP growth has been 0.78, 1.83, and 1.30 percent, respectively (Grazzi and Pietrobelli, 2016). Today, the average LAC TFP level is about 50% lower than in the U.S., while in 1960 it was more more than 70% of it (Fernandez-Arias, 2014).

There is theoretical consensus and abundant empirical evidence showing that innovation and entrepreneurship are central determinants of productivity growth. On one hand, the positive relationship among research and development (R&D), innovation, and productivity has been widely confirmed, both at the macro (e.g. Griliches, 1979; Coe and Helpman, 1995) and micro level (Griffith *et al.*, 2006; OECD, 2009; Mohnen and Hall, 2013). On the other hand, the available research also shows the positive effects of entrepreneurship on productivity growth (e.g. Audretsch *et al.*, 2006). It is argued that innovative entrepreneurs are at the center of the Schumpeterian view of creative destruction. In this view, innovation and entrepreneurship enhance productivity growth by generating more competitive pressures, achieving efficiency gains, and facilitating resources reallocation from low to high productivity firms. In fact, most of the evidence shows that large productivity gains come from this selection process.

For a long time, most of this literature was restricted to developed countries, while data availability limited the research in emerging economies, raising doubts

about the validity of this relationship in the Latin-American context. However, in the past decade the widespread deployment of novel statistical instruments –like innovation surveys– in the region has allowed researchers in LAC to start to produce empirical evidence, generally confirming the importance of innovation and entrepreneurship as engines of productivity growth also in LAC.

This evidence has led public authorities throughout the region to increase the variety of instruments promoting entrepreneurship and innovation, emphasizing their role in the countries' development agendas. However, these efforts have not been accompanied by a relevant increase in public and private investment, which, with few exceptions, remains very limited, even after controlling for income per capita. In 2015, the R&D over GDP ratio in Latin America in 2015 was 0.7%, compared to over 4% in Korea and Israel (RICYT and WDI, 2018). This situation is also confirmed by STI output indicators such as scientific publications, patents, and high technology exports, which are extremely low.

This raises some very relevant questions. How this performance can be improved? What are the main barriers to innovation and entrepreneurship? What public policies are required to strengthen the link between innovation and entrepreneurship and productivity? What new instruments need to be created? How can the venture capital industry be developed to deal with the financing difficulties of new firms? How to enhance the presence and survival of high-impact new ventures?

The papers in this special issue, some of them presented at the First Conference of the Latin American Network on Economics of the Innovation and Entrepreneurship organized by the Inter-American Development Bank in July 2017, contribute to answers these and other questions related to innovation and entrepreneurship in the region.

This paper is structured as follows. The second section reviews the available empirical evidence on the determinants of innovation and entrepreneurship in LAC. The third section presents the evidence on the impact of public programs. The fourth section summarizes the papers in this issue. After this review of the evidence for Latin America, we conclude that more work needs to be done. First, more high-quality research is required to help policy makers to make better decisions and implement adequate instruments. Second, there are new questions and challenges that need to be investigated such as those coming from the emergence of topics such as the digital economy, social and green innovation, and creative industries. Third, more and better evidence on the impact of innovation and entrepreneurship programs is required.

2. Determinants of Innovation and Entrepreneurship in Latin America

There is growing literature looking at the main determinants of innovation and entrepreneurship in Latin America. This has been mainly motivated by the increasing availability of two main sources of information: innovation surveys

that follow a similar questionnaire in the Community Innovation Survey and the surveys provided by the Global Entrepreneurship Monitor. Recently, the World Bank has developed several enterprise surveys that have also collected information on innovation activities and have been used for studying the determinants and impacts of innovation.

2.1. Innovation Studies

The studies generally analyze the determinants of innovation, using indicators of innovation input, such as R&D or innovation investment, and diverse indicators of innovation outcomes, especially self-reported measures of introduction of new products and processes. For several countries, the methodology developed by Crépon *et al.* (1998) has been applied in order to jointly analyze the factors affecting R&D investment, the impact of R&D (or innovation investment) on innovation outcomes, and finally how innovation affects firms' performance, particularly using a proxies for productivity. The first research for Latin American countries using this methodology are Benavente (2006) for Chile and Chudnovski *et al.* (2006) for Argentina. The main findings regarding the determinants of innovation in the case of Chile is that size and market share increase the probability of R&D investment, but not the intensity of R&D. Contrary to what is expected, R&D intensity is not found to affect innovation outcomes. In the case of Argentina, the evidence indicates that only firm size seems to affect the probability of investment in innovation activities. Most of the other variables, such as exporting, belonging to a group, or being multinational, do not affect either innovation investment nor innovation outcomes. Their findings show that the probability of introducing product or process innovation positively depends on the acquisition of technology and in-house R&D.

Alvarez *et al.* (2011) uses four innovation surveys for Chile (1995, 1996, 2001, and 2004) and also applies the CDM model. These results confirm the importance of size in the probability of R&D investment. They also find that cooperation with universities and technological centers increase R&D investment. In the case of innovation outcomes, they estimate a model for product and process innovation separately and find that R&D investment intensity increases the probability of introducing new products, but not new processes.

Crespi and Zuñiga (2012) try to improving comparison across countries using the same methodology and specification for a sample of 5 Latin American countries: Argentina, Chile, Colombia, Costa Rica, and Uruguay. There are some findings that are common across countries as size increases the probability of investing in innovation. However, some other variables such as exporting, being part of a multinational, and receiving public support have a positive impact on investment for some but not all. In most of these countries, with the exception of Argentina, they find that firms that have patents are more likely to invest in innovation activities. A robust finding across countries is that innovation investment increases the probability of introducing innovations, and that innovation has a positive impact on productivity.

More recent papers have explored the determinants and impact of innovation comparing manufacturing industries with the services sector, under the premise that the nature of innovation could be different in these two industries. Aboal and Garda (2016), however, find some similarity across industries in Uruguay regarding the impact of firm size, R&D cooperation, the use of public financial support, patent protection, and the use of market sources of information on the decision to invest in innovation. Their findings reveal that investment in innovation activities and the size of the firm affect technological and non-technological innovations.

For Chile, Álvarez *et al.* (2015) find that similar factors such as exporting, patent protection, and size affect the decision of investing in innovation for both sectors. They also find that exporting and cooperation positively affect innovation intensity. In the case of technological innovation, their results for both manufacturing and service industries indicates a positive impact from exporting and cooperation in R&D projects.

In the case of Mexico, Santiago *et al.* (2017) analyze the role of innovation barriers and how they are perceived by the firms in the service sector. Focusing on policy implications, they conclude that policies aimed at boosting demand for locally generated innovations help in enhancing the innovation capacity of firms interested in innovation and attack factors that reduce the interest of firms in innovation.

Gallego *et al.* (2015), for Colombia, also find similarities for both industries. Their results indicate that the probability of undertaking innovation increases with investment in R&D labs and firm size. Additionally a higher innovation investment increases the probability of introducing innovations.

Other recent literature has been exploiting self-reported information of obstacles to innovation, looking at their causal and quantitative impacts. Alvarez and Crespi (2015), for Chilean firms, find a negative and large impact of financial constraints, especially for small firms and process innovation. Also for Chilean firms, there is evidence of a negative impact from low access to knowledge (Canales and Alvarez, 2017). This contrasts with abundant empirical evidence for developed countries using innovation surveys for understanding the impact of several perceived obstacles (Mohnen, *et al.* 2008; Savignac, 2008; D´ Este *et al.*, 2012), their effects on different firms and industries (Costa Campi *et al.* 2014), and the complementarities among obstacles (Galia and Legros, 2004).

One relevant question in this literature is the impact of competition on innovation. Although the relationship between innovation and competition has been largely analyzed (Aghion and Howitt, 1992 and 2006; among others), the empirical evidence on competition's impact on innovation is not yet conclusive. Schumpeter (1942), based on the idea of creative destruction, argued that higher competition could be detrimental to innovation. A monopolist has a higher incentive to innovate than competitive firms, because it captures the total gains from its innovations instead of losing some of the gains to its competators. Later Arrow (1962), Scherer (1980), and Porter (1990) questioned Schumpeter's results, suggesting that incumbents' fears of being run out of the market explain

how competition could be positively associated with innovation. The incumbent firms need to innovate in order to survive the entrants´ competition. More recently, Aghion *et al.* (2005), following Scherer (1967), produced a non-linear (U-inverted) relationship between competition and innovation.

The evidence of this relationship is very scarce for developing countries, in general, and for Latin American countries in particular. Moreover, although some researchers have acknowledged the endogenous nature of competition, not all of them have dealt with this problem. Surveys of this literature indicate that better efforts need to be made to uncover the causal impact of competition on innovation (Cohen, 2010). Among the exceptions, Crespi *et al.* (2016) include a variable measuring the intensity of competition as determinant of the decision to invest in R&D, and they find a non-significant relationship with R&D investment.[1] The studies for some specific countries find controversial evidence, In the case of Chile, for example, Crespi and Katz (1999) find that innovation is positively correlated with industry concentration. In contrast, Alvarez *et al.* (2011) do not find evidence of a significant effect associated with competition.

There are several implications from this selective review of the literature. First, even using a same framework as the CDM model, there is large discrepancy in the specification of the equations, which makes it very difficult to identify the main determinant of innovation. One very clear and robust result is that firm size increases the probability of investing in R&D (and also in innovation). Second, in the case of common specifications such as in Crespi and Zuñiga (2012), the main determinants of innovation, investment, and outcomes tend to differ across countries. This casts doubt on the relevance for innovation policies derived from pooled regressions. Third, there is lot to be done in terms of creative identification strategies for looking at causal determinants of innovation, especially those related with barriers such as lack of competition and human capital.

2.2. Entrepreneurship Studies

In the case of entrepreneurship there is an incipient literature looking at its main drivers in Latin America. In fact, two recent reports sponsored by international agencies have looked at this issue in the region (Lora and Castellani, 2014; Lederman *et al.*, 2013). The literature on determinants of entrepreneurship focus on two main groups of variables: individual characteristics and economic context. The work of Ardagna and Lusardi (2010), although they do not focus their analysis on Latin American countries, is an example of pooling data of individuals across countries to look at the role of individual characteristics and regulatory constraints in explaining differences in entrepreneurship. In contrast to most of evidence reviewed here, they look at particular barriers and their interaction with individual features.

[1] Competition is measured as a self-reported variable indicating the number of competitors in the main market for the main product

Most of this literature shows that personal traits are important (Parker, 2009). This has been also found in studies for Latin American countries. Mancilla and Amorós (2012), using data from the GEM for Chile, focus on socio-cultural determinants and find a positive impact of role models and being not afraid of entrepreneural failure. In the same line, Aboal and Veneri (2016) also show that personality traits are positively associated with entrepreneurial behavior in Latin America, especially for those that entrepreneurial behavior is stronger (full-time entrepreneur and employs personnel). Interestingly, they also find that environment is important ing understanding the differences in the personality traits of entrepreneurs in Latin America and the US.

Using also a sample of Latin American countries, Bukstein and Gandelman (2015) study the effect of business cycles and demographic factors on entrepreneurship. Regarding age, they find evidence of an inverse U shape with the maximum between 40 and 50 years. They explore some differences across countries and find that in Brazil, Mexico, and Uruguay, entrepreneurship decreases in younger cohorts, but that is not the case for Peru and Chile.

The role of the family has been also explored as relevant for new ventures. Velez-Grajales and Velez-Grajales (2014) use the 2006 ESRU Survey on Social Mobility in Mexico to investigate both the determinants of the decision to become an entrepreneur and the entrepreneurs' intergenerational household wealth mobility. They find a strong effect of the father being an entrepreneur rather than an individual's initial wealth or educational attainment. Regarding intergenerational mobility, their results show that entrepreneurial activity has more effect on the individual incomes of those whose parents belonged to the extreme ends of the socioeconomic distribution. Also their evidence indicates it is more likely for entrepreneurs to experience greater upward wealth mobility than non-entrepreneurs.

The analysis of several competing hypotheses is provided by Djankov *et al.* (2007), who use a new survey on entrepreneurship in Brazil to test three of them: economic and legal institutions, sociological characteristics, and individual features. They find that sociological characteristics have the strongest influence on becoming an entrepreneur. Looking at determinants of success in entrepreneurship, they find that this is primarily determined by the individual's intelligence and higher familial education. They also find evidence that entrepreneurs are not more self-confident than non-entrepreneurs and that overconfidence negatively affects business success.

There are other papers looking at related dimensions as risk aversion and differentiating by entrepreneur type. Sepulveda and Bonilla (2014) look at the probability of fearing the failure of a new venture. Their findings indicate that fear of failing expectations is lower for males, for those with more years of formal education, and those who believe they have the necessary skills to develop a new venture. They also find a non-linear relationship with age. The impact is first positive, but negative after some point. Another interesting finding is that a prior experience of business failure increases risk aversion, and thus reduces the probability of becoming an entrepreneur. One study by Montes-Rojas and Siga

(2009) shows that determinants of entrepreneurship vary by type: own-account workers and micro-entrepreneurs (eg. those who have some employees). They find that young, uneducated, and middle-aged people have a higher probability of becoming own-account workers, while the probability of becoming micro-entrepreneurs strictly increases with both age and education.

The analyzed studies show that the empirical analysis on entrepreneurship is less abundant than innovation studies, and the set of questions tends to be more varied. In general, it is found that three main groups of variables are the main determinants of entrepreneurship: socio-demographic characteristics, personality traits (risk aversion, fear of failure, etc.), and the economic context (regulation, business cycles etc). Similarly to the innovation studies, there are large differences across specifications and data that makes it difficult to identify the most robust drivers and obstacles to innovation. What is mostly missing are more detailed studies about the explanatory variables related with successful and innovative entrepreneurs.

3. Empirical Evidence on the Impact of Public Policies

The literature presented in the previous section constitutes the basis for the implementation of public programs aimed at increasing innovation and high-impact entrepreneurship in LAC. From a theoretical point of view, the justification of public intervention in the area relies on the general assumption that private actors invest in innovation less than the socially desirable amount. In fact, knowledge has a nature of a public good (Nelson, 1959; Arrow, 1962) and various spillover effects are present. Moreover, the returns to innovation investments are uncertain by definition and usually need a long time to generate profits. This together with the intangible nature of most innovation investments and the asymmetric information on probability of success between innovators and potential financers, leads to problems in the correct functioning of financial markets for this kind of projects. Finally, coordination failures are also present at multiple levels among the actors of the national innovation system, for example in access to knowledge or technological infrastructure.

Even if the Latin American experience with innovation policy started in the 1950s, only recently has the literature tried to rigorously measure the impacts and determine the real cost effectiveness of these interventions in order to provide reliable evidence to LAC policymakers. The delay in the rigorous assessment of the effectiveness of these instruments –compared to, for example, social policy, where impact evaluations appeared much earlier in the region– is caused by several different factors. In addition to the already mentioned data scarcity, the difficulties come from the rationale and form of the interventions. First, these policy instruments are generally supposed to generate positive externalities, but measuring them can be extremely challenging. Second, the interventions consist of multiple coordinated instruments with different beneficiaries and timing. This structure generates several difficulties from a methodological point of view, both

in terms of the applicable impact evaluation techniques and the data required to perform them (Crespi, Maffioli, and Rastelletti, 2014).

Despite these difficulties, scholars in the region have been able to start producing more rigorous evaluations of innovation policies. On one hand, the diffusion of techniques such as regression discontinuity design has facilitated the identification of counterfactuals in a context where selection bias issues are extremely problematic. On the other hand, the implementing agencies have improved their monitoring systems, generating more reliable and detailed information on program beneficiaries, which –together with the aforementioned increase in micro-data collection– has increased the available data for impact evaluations.

Most of the impact evaluations performed in LAC have evaluated the effects of matching grants schemes or R&D tax incentives on firms' innovation efforts, assessing the crowding in/crowding out effects of the instrument on private investment. Studies of this type have been performed in Argentina, Brazil, Chile, Colombia, Mexico, Panamá, and Uruguay. Most of the research found a positive and significant effect of such programs, suggesting that such instruments are effective in crowding-in private resources and are not simply replacing them.

Fewer studies analyzed the impact of such programs on the performance of the beneficiaries,[2] with mixed results. In general, these papers have sought effects on firm's innovation outputs and labor productivity, but in this case, a longer time period is often needed to detect them. An effort in this direction has been performed by Crespi *et al.* (2015), which evaluated the effect of the innovation promotion programs administered by COLCIENCIAS in Colombia, finding that the effects on TFP and product innovation become relevant only between three and five years after the treatment. Also, they found some increase on employment only in the very long run (six years after treatment). Moreover, Alvarez, Crespi, and Cuevas (2012) reassessed various programs already evaluated in the short run, repeating the exercise over a longer period, generally finding significant impacts on labor productivity.

However, most of these evaluations only focused on the private returns produced by innovation programs, neglecting the fact that a main reason for implementing such programs is the generation of positive externalities. Only a few papers have tried to deal with this central issue in LAC. For example, Castillo *et al.* (2016) focused on skilled labor mobility as the main mechanism for knowledge transmission between firms in Argentina. Their results confirm that that the FONTAR program has been effective in fostering the growth of participant firms and their exports, as well as boosting productivity. But, more interestingly, they also showed that the hiring of qualified workers who were

[2] More research has been performed on the effects of technology extension programs, especially in the agriculture sector. See for example Maffioli *et al.* (2013) or Lopez and Maffioli (2008).

exposed to the innovation project is linked to growth and productivity gains even in receiving firms that were not directly exposed to the program.

Another interesting line of research is related to the existence of complementarities between different innovation policy instruments. Alvarez, Crespi and Cuevas (2012) found strong evidence at this respect by evaluating the combined effects of Chile's National Fund for Technology and Productivity (Fondo Nacional de Desarrollo Tecnológico y Productivo (FONTEC)–now Innova Chile), which supports individual firms; and its Fund for Scientific and Technological Development (Fondo de Fomento al Desarrollo Científico y Tecnológico (FONDEF)), which encourages university-firm collaboration.

Compared with the literature related to innovation funds and R&D incentives, the evaluations of high-impact entrepreneurship programs in the region are very few and with mixed results. Bonilla and Cancino (2011) evaluated the impact of the Seed Capital Program implemented by Chile's Technical Cooperation Services (Servicio de Cooperación Técnica SERCOTEC), finding a positive impact on sales and number of employees. However, while the employment results are stable, the statistical significance on sales depends on the model used. The results also show that participating in the program has no incidence on the probability of later obtaining financing. Butler *et al.* (2016) analyzed the impact of a policy aimed at promoting innovative startups in Buenos Aires through the provision of funding and technical assistance in Buenos Aires, finding significant effects on enterprise creation and survival as well as on employment.

There are several programs evaluated in the context of micro-entrepreneurship, some of them in LAC. Cho and Honorati (2014) review that evidence and conclude that most of the programs did not affect business performance, even they have been effective in improving business practices and knowledge. Some evaluations using RCT are currently on going and will be able to provide interesting insights for the design of this kind of programs.

4. This issue

The articles in this issue explore different dimensions of innovation and entrepreneurship in Latin American countries. The work by Martin analyzes the impact of technology on wages on Colombia, showing that there is non-linear relationship between the use of internet and individual salaries. Similar to studies for developed countries, the results suggest that workers in the middle of the skill distribution receive the lowest wage premium. In contrast, his findings indicate low-skilled workers benefit the most from internet use. This indicates there are different implications of technology on income distribution in the context of developing countries in comparison with rich ones.

In the line of studies looking at the determinants of innovation, Bello and Bianchi look at the relationship among educational diversity, organizational structure, and innovation for Uruguayan firms. This one of the first papers analyzing how diversity can affect innovation. Their findings are in line with the idea that

educational diversity reduces the probability of introducing radical innovations but the impact is moderated by the organizational structure. There does not seem to be a relationship among these variables using incremental innovations.

Echeverry and Reyes use an experimental design aimed at Colombian entrepreneurs to assess the role of the endowment effect in shaping the risk-taking behavior of entrepreneurs, and how the potential of losing their firms leads them to take higher risks. The results show that entrepreneurs are more likely to accept a higher level of risk when it is related to their companies, providing a possible explanation for the continuing operation of underperforming firms, as well as for the valuation differences that difficult the investment process.

The final three papers evaluate the impact of public instruments to promote innovation and entrepreneurship in Argentina, Uruguay and Chile. Pereira, Correa and Sacattolo provide evidence on the impact of non-refundable grants (from FONTAR) on Argentinean firms. Using a difference-in-differences approach for a panel in the period 2007-2013, they find evidence that FONTAR was associated with an increment of innovation and R&D investment over sales. They also find that the impact is heterogeneous across firms, mainly concentrated on smaller and younger firms. This is consistent with the idea that grants increase investment in more financially constrained firms.

In a similar fashion, Bukstein, Hernandez and Usher evaluate the impact of the innovation promotion programs carried by the National Research and Innovation Agency (ANII) of Uruguay. Using a combination of non-experimental methods, the authors offer evidence that these programs are effective for increasing investment in innovation. Also, participating firms are found to have larger probability of successfully introducing new products and processes, but not of having better economic performance indicators.

Finally, Navarro analyzes the likely impact of CORFO's Seed Capital Program (SCP) on the participating enterprises' performance. Even if the data availability does not allow him to fully control for selection bias, the results suggest that the firms benefitting from the program have higher probability of starting activity, growing, and surviving on the market.

5. Refereences

Aboal, D., and Veneri, F. (2016). "Entrepreneurs in Latin America". *Small Business Economics*, *46*(3), 503-525.

Aboal, D., and Garda, P. (2016). "Technological and non-technological innovation and productivity in services vis-à-vis manufacturing sectors". *Economics of Innovation and New Technology*, 25(5), 435-454.

Aghion, P., N. Bloom, R. Blundell, R. Griffith and P. Howitt (2005). "Competition and Innovation: an inverted U relationship". *Quarterly Journal of Economics CXX*, 701-728.

Aghion, P. and P. Howitt (1992). "A Model of Growth Through Creative". *Econometrics,* 60, 323-251.

Aghion, P. and P. Howitt (2006). "Appropriate growth policy: A unifying framework". *Journal of the European Economic Association,* 4. 269-314.

Álvarez, R., Bravo-Ortega, C., and Zahler, A. (2015). Innovation and productivity in services: evidence from Chile. *Emerging Markets Finance and Trade*, *51*(3), 593-611.

Álvarez, R. and G. Crespi (2015). "Heterogeneous Effects of Financial Constraints on Innovation: Evidence from Chile", *Science and Public Policy*, 42 (5): 711-724.

Álvarez, R., Crespi, G., and Cuevas, G. (2012). Public Programs, Firm Performance and Employment: Evidence from Chile. Inter-American Development Bank Technical Notes, IDB-TN-375, 1-46.

Álvarez, R., Bravo-Ortega, C. and L. Navarro (2011). "Innovation, R&D and Productivity: The Chilean Case", CEPAL Review, 104: 141-166.

Ardagna, S. and A. Lusardi (2010): "Explaining International Differences in Entrepreneurship: The Role of Individual Characteristics and Regulatory Constraints", in J. Lerner y A. Schoar (Eds): International Differences in Entrepreneurship. The University of Chicago Press.

Arrow, K. J. (1962). "The economic implications of learning by doing". *The Review of Economic Studies*, 29(3), 155-173.

Audretsch, D. B., Keilbach, M. C., and Lehmann, E. E. (2006). Entrepreneurship and economic growth. Oxford University Press.

Bello-Pintado, A., & Bianchi, C. (2018). "Educational diversity, organizational structure and innovation performance: Evidence from Uruguayan industry". *Estudios de Economía,* 45(2).

Benavente, J. M. (2006). "The role of research and innovation in promoting productivity in Chile". *Economics of Innovation and New Technology*, *15*(4-5), 301-315.

Bonilla, Claudio A., y Christian A. Cancino (2011). The Impact of the Seed Capital Program of SERCOTEC in Chile. IDB-WP-279. IDW Working Paper Series.

Bukstein, D., and Gandelman, N. (2015). "Cohort, age and business cycle effects in entrepreneurship in Latin America". *Entrepreneurship Research Journal*.

Busom, I., and Vélez-Ospina, J. A. (2017). "Innovation, Public Support, and Productivity in Colombia. A Cross-industry Comparison". *World Development* (99), 75-94.

Bruton, G. D., Ahlstrom, D., and Obloj, K. (2008). "Entrepreneurship in emerging economies: Where are we today and where should the research go in the future". *Entrepreneurship Theory and Practice*, 32(1), 1-14.

Bukstein, D., Hermández, E., & Usher, X. (2018). "Impacto de los instrumentos de promoción de la innovación orientada al sector productivo: el caso de ANII en Uruguay". *Estudios de Economía,* 45(2).

Butler, Inés, Gabriela Galassi, y Hernán Ruffo (2016). "Public funding for startups in Argentina: an impact evaluation". *Small Business Economics,* 46 (2): 295-309.

Canales, M., and Álvarez, R. (2017). "Impacto de los obstáculos al conocimiento en la innovación de las empresas chilenas". *Journal of Technology Management and Innovation*, 12(3), 78-85.

Castillo, V., L. Figal Garone, A. Maffioli, S. Rojo, and R. Stucchi (2016). The Effects of Knowledge Spillovers through Labor Mobility. MPRA Paper 69141, University Library of Munich, Germany.

Cho, Y., and M. Honorati (2014). "Entrepreneurship Programs in Developing Countries: A Meta Regression Analysis". *Labour Economics*, 28, 110-130.

Chudnovsky, D., López, A., and Pupato, G. (2006). "Innovation and productivity in developing countries: A study of Argentine manufacturing firms' behavior (1992-2001)". *Research Policy*, 35(2), 266-288.

Coe, D., and Helpman, E. (1995). "International R&D Spillovers". *European Economic Review,* 39(5), 859-887.

Cohen, W. M. (2010). "Fifty years of empirical studies of innovative activity and performance". In *Handbook of the Economics of Innovation* (Vol. 1, pp. 129-213). North-Holland.

Costa-Campi, M. T., Duch-Brown, N., and García-Quevedo, J. (2014). "R&D drivers and obstacles to innovation in the energy industry". *Energy Economics*, 46, 20-30.

Crépon, B., E. Duguet y J. Mairesse (1998). "Research and development, innovation and productivity: an econometric analysis at the firm level", *Economics of Innovation and New Technology*, 7(2): 115-158.

Crespi, G., Tacsir, E., and Vargas, F. (2016). Innovation dynamics and productivity: Evidence for Latin America. In Firm Innovation and Productivity in Latin America and the Caribbean (pp. 37-71). Palgrave Macmillan, New York.

Crespi, G., L. Figal Garone, A. Maffioli, and M. Meléndez (2015). "Long-term productivity effects of public support to innovation in Colombia". *Emerging Markets Finance and Trade* 51(1): 48-64.

Crespi G., A. Maffioli and A. Rastelletti (2014). "Investing in Ideas: Policies to Foster Innovation". In E. Fernández Arias, G. Crespi, and E. Stein (eds.), *Rethinking Productive Development: Sound Policies and Institutions for Economic Transformation.* Development in the America Series. Washington DC: Inter-American Development Bank and New York: Palgrave Macmillan.

Crespi, G., and Zúñiga, P. (2012). "Innovation and productivity: evidence from six Latin American countries". *World Development*, 40(2), 273-290.

Crespi, G., and Katz, J. (1999). "R&D expenditure, market structure and" technological regimes" in Chilean manufacturing industry". *Estudios de Economía*, 26(2), 163-186.

Djankov, S., Qian, Y., Roland, G., and Zhuravskaya, E. (2007). What makes a successful entrepreneur? Evidence from Brazil. *Center for Economic and Financial Research (CEFIR) in its series Working Paper with* (w0104).

D'Este, P., Iammarino, S., Savona, M., and von Tunzelmann, N. (2012). "What hampers innovation? Revealed barriers versus deterring barriers". *Research Policy*, 41(2), 482-488.

Echeverry, I., & Reyes, S. (2018). "The Endowment Effect On Entrepreneurs: A Risky Attachment". *Estudios de Economía,* 45(2).

Fernández-Arias, E. (2014). Productivity and Factor Accumulation in Latin America and the Caribbean: A Database (2014 update).

Galia, F., and Legros, D. (2004). "Complementarities between obstacles to innovation: evidence from France". *Research Policy*, 33(8), 1185-1199.

Gallego, J. M., Gutiérrez, L. H., and Taborda, R. (2015). "Innovation and productivity in the colombian service and manufacturing industries". *Emerging Markets Finance and Trade*, 51(3), 612-634.

Grazzi, M., and C. Pietrobelli (2016). Firm innovation and productivity in Latin America and the Caribbean . Palgrave Macmillan, New York.

Griffith, R., E. Huergo, J. Mairesse, and B. Peters (2006). "Innovation and Productivity across Four European Countries". *Oxford Review of Economic Policy,* 22(4): 483-498.

Griliches, Z. (1979). "Issues in Assessing the Contribution of Research and Development to Productivity Growth". *Bell Journal of Economics*, 10(1): 92-116.

Lederman, D., Messina, J., Pienknagura, S., and Rigolini, J. (2013). Latin American entrepreneurs: many firms but little innovation. The World Bank.

López, F. and A. Maffioli (2008). Technology Adoption, Productivity and Specialization of Uruguayan Breeders: Evidence from an Impact Evaluation. Working Paper No. 07/08. Washington, DC: Inter-American Development Bank.

Lora, E., and Castellani, F. (Eds.) (2013). Entrepreneurship in Latin America: A Step Up the Social Ladder?. Inter-Americsan Development Bank.

Maffioli, A., D. Ubfal, G. Vázquez-Baré, and P. Cerdán-Infantes (2011). "Improving Technology Adoption in Agriculture through Extension Services: Evidence from Uruguay". *Journal of Development Effectiveness,* 5(1): 64-81.

Mancilla, C., and Amoros, J. E. (2012). "La influencia de factores socio-culturales en el emprendimiento, evidencia en Chile 2007-2010". *Multidisciplinary Business Review*, *5*(1), 15-25.

Martin, D. A. (2018). "U-shaped wage curve and the Internet: The Colombian case". *Estudios de Economía,* 45(2).

Mohnen, P. and B. Hall (2013). "Innovation and Productivity: An Update". *Eurasian Business Review* 3(1): 47-65.

Mohnen, P., Palm, F. C., Van Der Loeff, S. S., and Tiwari, A. (2008). "Financial constraints and other obstacles: are they a threat to innovation activity?". *De Economist*, *156*(2), 201-214.

Montes Rojas, G. V., and Siga, L. (2009). "On the nature of micro-entrepreneurship: evidence from Argentina". *Applied Economics*, 41(21), 2667-2680.

Navarro, L. (2018). "Entrepreneurship Policy and Firm Performance: Chile's CORFO Seed Capital Program". *Estudios de Economía,* 45(2).

Nelson, R. R. (1959). "The Simple Economics of Basic Scientific Research". *Journal of Political Economy,* 67(3): 297-306.

OECD (Organisation of Economic Co-operation and Development) (2009). Innovation in Firms: A Microeconomic Perspective. Paris: Organization for Economic Cooperation and Development (OECD).

Parker, S. C. (2009). The Economics of Entrepreneurship. Cambridge University Press.

Pereira, M., Correa, J., & Scattolo, G. (2018). "Public support to firm-level innovation: an evaluation of the FONTAR program". *Estudios de Economía,* 45(2).

Porter, M. (1990). The competitive advantage of nations, Macmillan.

Santiago, F., De Fuentes, C., Dutrénit, G., and Gras, N. (2017). "What hinders innovation performance of services and manufacturing firms in Mexico?". *Economics of Innovation and New Technology*, 26(3), 247-268.

Savignac, F. (2008) "Impact of financial constraints on innovation: What can be learned from a direct measure?", *Economics of Innovation and New Technology*, 17:6, 553-569, DOI: 10.1080/10438590701538432.

Scherer, F. (1967). "Market structure and the employment of scientists and engineers". *American Economic Review,* 57, 524-531.

Scherer, F. (1980). Industrial Market Structure and Economic Performance, Rand McNally, Chicago, 2nd ed.

Schumpeter, J. (1942). Capitalism, Socialism and Democracy, New York: Harper.

Sepúlveda, J. P., and Bonilla, C. A. (2014). "The factors affecting the risk attitude in entrepreneurship: evidence from Latin America". *Applied Economics Letters*, *21*(8), 573-581.

Vélez-Grajales, V., and Vélez-Grajales, R. (2014). "Is entrepreneurship inherited? A study of intergenerational social mobility in Mexico". *Latin American Journal of Economics*, *51*(2), 247-278.