Foreign Competition and Innovation in Latin America

Integration and Trade Sector

Competitiveness, Technology and Innovation Division

Roberto Álvarez
José Miguel Benavente
Gustavo Crespi

DISCUSSION PAPER Nº

IDB-DP-00728

December 2019

Foreign Competition and Innovation in Latin America

Roberto Álvarez
José Miguel Benavente
Gustavo Crespi

Inter-American Development Bank
Integration and Trade Sector
Competitiveness, Technology and Innovation Division
December 2019

Foreign Competition and Innovation in Latin America*

Roberto Álvarez	José Miguel Benavente	Gustavo Crespi
Department of Economics	CTI	CTI
University of Chile	IDB	IDB

Abstract

Using microlevel data for several Latin American countries, we provide novel evidence on the relationship between foreign competition and innovation. We find that greater foreign competition has a positive impact on diverse indicators of technological innovation. We are unable to find an inverted-U relationship, indicating that for these countries there is room to increase innovation through strengthening competition in product markets.

JEL classifications: F61, O32

Key words: Foreign competition, innovation efforts, firm-level data, Latin American countries.

* We would like to thank Ernesto Stein and Mauricio Mesquita Moreira for their valuable comments and suggestions and Pelayo Herraiz and Valeria Cordova for their excellent research assistance.

1. INTRODUCTION

Most Latin American economies are lagging well behind advanced countries in productivity terms. This has been widely documented and poses a serious challenge to achieving sustained growth in the region (IDB, 2010). The literature suggests that one of the main drivers for productivity growth is innovation, either by expanding the technological frontier or by imitating and absorbing new technologies from the rest of the world. However, recent decades have shown how difficult enhancing Latin American countries' innovation performance is.

It was widely expected that reducing both trade barriers and restrictions on foreign direct investment as part of structural reforms in Latin America would help improve innovation and productivity. However, the available evidence tends to be inconclusive about the impact of greater foreign competition on innovation. In this paper, we analyze whether competition has affected innovation in Latin American countries. Several studies have argued that low levels of innovation activity in Latin America are the result of shortfalls in competitive pressure. Lederman et al. (2014) indicate that limited competition is one of the main factors inhibiting the entry of innovative entrepreneurs in the region. This factor would be particularly important for industries that are less exposed to international competition. The benchmark for Latin American countries in terms of revealed market concentration in such industries shows that LAC economies are in the upper tail of the market concentration indicator.

Similarly, Cole et al. (2005) argue that competition barriers may explain the TFP gap of LAC countries with respect to developed economies. The authors show evidence that Latin America has many more international and domestic barriers to competition than Western and successful East Asian countries do. They also demonstrate how large reductions in competitive barriers have successfully brought some countries' productivity levels on par with those of the West.

There are several papers that reveal that competition increases innovation, and many others indicating that competition has a negative impact on innovation. Both findings were in part reconciled by Aghion et al. (2005), who show evidence for the UK of an inverted-U relationship between innovation and competition. They introduce the idea that innovation is a way of escaping competition and that there are two effects—escaping competition and rent dissipation—that determine how competition affects innovation. In this context, more competition may enhance innovation if it reduces pre-innovation rents more than it reduces post-innovation ones. Nevertheless, this evidence has been also challenged. Correa (2012) has shown evidence of a structural break in 1982 that makes the inverted-U relationship disappear. Using data for the US, Hashmi (2013) finds that competition has a negative impact on innovation. More recent evidence from Autor et al. (2016), also for the US, indicates that import competition from China affects innovation negatively.

For developing countries, one recent paper by Gorodnichenko et al. (2010) finds that international competition has a positive impact on innovation. In the case of Latin American countries, little empirical research has looked at the causal effect of competition. In Chile, some studies using initial versions of the innovation survey have found a positive correlation between market concentration and innovation (Crespi and Katz, 1999).[1] Using information for Chilean and Mexican firms, Álvarez and Robertson (2004) show evidence that firms that are more exposed to foreign competition are more innovative. Also for Chile, Fernandes and Paunov (2013) find that increased import competition from low-wage countries has had a positive impact on upgrading quality among domestic producers. This is very similar to the evidence for OECD countries provided by Bloom et al. (2016). For Uruguay, De Elejalde et al. (2018) find that competition has a negative impact on the resources spent on innovation activities, but that competition has a positive effect on the efficiency of innovation expenditures.

[1] See Krasniqi and Kutllovci (2008) for similar evidence in the Czech Republic, Poland, and Hungary.

We contribute to this literature by providing novel evidence for Latin American countries and by dealing with endogeneity issues using instrumental variables. We find that greater foreign competition has a positive impact on diverse indicators of technological innovation. We are unable to find an inverted-U relationship like Aghion et al. (2005), indicating that for these countries there is room to increase innovation by strengthening competition in product markets.

This paper is structured as follows. In the next section, we describe the data. Section 3 sets out our methodological approach. Our results are described in section 4. Finally, section 5 concludes.

2. DATA

The data is obtained from the World Enterprise Survey (WES), which is sponsored by the World Bank and available for the years 2003, 2006, 2009, 2010, and 2017. The surveys use the same sampling frame and identical questionnaires in all countries, facilitating comparisons between them. The representativeness of the survey is guaranteed by stratified random sampling and the inclusion of firms in both the manufacturing and services sector and enterprises of different sizes and in different locations.

This data contains information on a whole spectrum of firm characteristics such as sales and exports, the industry in which the firm operates, the human capital it employs, innovation activities (including R&D expenditure), and financial and information sources. It also contains information on general and innovation-related linkages with other firms and institutions, obstacles to innovation (such as financial constraints), and innovation outputs (new products or processes). The latter—namely total innovation, product innovation, process innovation, and R&D—will serve as dependent variables in our regressions. Unfortunately, we cannot exploit the panel characteristics of the dataset because the questionnaire only included questions on foreign competition in 2006.

One of the most significant questions that the WES includes is the following: "*How important or unimportant is pressure from foreign competitors on production costs of existing products*?", as we will define our main explanatory variable (*Forcomp*) based on the responses to this, which take the form of a single value ranging from 1 (nonimportant) to 4 (highly important).

Table 1 shows the descriptive statistics for each variable used in the estimation. As can be appreciated, the total innovation rate (defined as the percentage of firms that innovated on either processes or products) is about 60%, with the incidence of product innovation (59%) being higher than that of process innovation (51%). In the case of input innovation, about 37% of firms stated that they invest in R&D. Furthermore, in relation to foreign competition, the average for the entire sample is 2.5, which is somewhere between being a "slightly important" factor and an "important" factor in terms of production costs.

Table 2 presents information for the countries included in the estimation. Regarding foreign competition, the greatest degree of competition is experienced by firms in Mexico (2.67) and Peru (2.76), and the lowest by firms in Argentina (2.25) and Bolivia (2.25). In terms of innovation, the country with the highest incidence of process or product innovation and where the probability of investing in R&D is highest is Peru, and the lowest is Mexico.

3. METHODOLOGY

We study the impact of foreign competition on innovation variables based on the following basic model:

$$I_{ijc} = \alpha_j + \alpha_c + \delta_1 Forcomp_{ijc} + \delta_2 Forcomp_{ijc}^2 + \delta X_{ijc} + e_{ijc}$$

Following Gorodnichenko et al. (2010), the *Forcomp* variable is defined at the firm level and, as was mentioned above, takes a single value ranging from 1 (not important) to 4 (highly important). The higher the

Forcomp variable, the more foreign competition there is. If the relationship is linear, the parameter δ_1 captures the impact of competition on innovation and is expected to be positive if greater competition increases the incentives for innovation.

The innovation measures that we use in the estimation are typically used in this literature. First, we define a dummy variable for firms that introduce either product or process innovations. We then use a dummy variable for each type of innovation. Lastly, we use a dummy variable for investment in R&D.

Vector X for explanatory variables closely follows the specification of Gorodnichenko et al. (2010) and is made up of the following: export share (exports/sales), import share,[2] size (log of employment), skill (share of skilled workers in total employment), firm age, a dummy variable for firms supplying the domestic market,[3] and distance to frontier.

We measure the distance to the technological frontier (within a country) as the difference between the productivity of the most productive firm in industry *j* in country *c* and the productivity of firm *i* in industry *j* in country *c*. We then divide this by the first term to scale it. Thus, following Aghion et al. (2005), this is:

$$Distance_{ijc} = \frac{\left(max \prod - pro_{ijc}\right)}{max \prod}$$

Productivity is measured as sales per worker, given that the data does not provide us with enough information to calculate TFP at the firm level. We estimate linear probability models in which we include dummy variables by industry and country.

In the estimation, we need to deal with the endogeneity of competition. This problem arises mainly from three sources. First, there may be causality in the opposite direction—that is, more innovation may affect competition in the industry. For example, a firm could be less affected by competition if it innovates products or processes to make itself more efficient and competitive. Moreover, the opposite may also be true. Second, several works have documented that self-reported measures of innovation obstacles, such as a lack of competition, are endogenous (Savignac, 2008; Mohnen et.al, 2008; and Álvarez and Crespi, 2015). One reason is that, for instance, a firm that does not invest in innovation (in the form of R&D, for instance) might justify this decision by reporting greater obstacles to doing so. Furthermore, in relation to the first reason, a firm that invests relatively more might perceive smaller obstacles. Third, foreign competition may be measured with error, which leads to attenuation bias in OLS estimators.

We deal with this issue by using variables that capture barriers to competition posed by regulations and corruption as instruments. These are sound instrumental variables as they affect the entry of new firms and competition but do not necessarily impact innovative activity. We also compute an index of reported barriers to competition to use as an instrumental variable. We do this by adding up the normalized answers to the following sets of questions:

Q1) How much of an obstacle is/are ……….. to the current operations of this establishment?

labor regulations, business licensing and permits, customs and trade regulations, access to land.

Q2) An informal gift/payment is expected or requested in return for:

an electrical connection, a water connection, a telecommunications connection, construction-related permits, an import license, an operating license.

All of these answers are normalized because the first set of questions is measured on a scale from 1 (unimportant) to 4 (highly important) and the variables in the second set are dummies (1 if yes and 0 if not). At the same time, it is important to note that using any of these questions alone may result in a weak

---

[2] This is defined as the percentage of total annual purchases of material inputs and/or supplies of foreign origin.
[3] On average, 69% of these firms do not export and 36% of them are importers.

instrument, given that each captures only one aspect of regulation. Consequently, totaling the normalized sum of them all provides a much more reasonable index for entry barriers.[4]

4. ECONOMETRIC RESULTS

We present the results for the OLS estimation in table 3, where we find a significant positive relationship between competition and innovation for the four dependent variables. In the case of firm characteristics, the results also indicate a positive association with size, exports, imports, skill composition, and sales on the domestic market. We find that distance to frontier has a negative effect on R&D expenditure but not on innovation outcomes.

Table 4 shows the IV estimations for the basic equation including foreign competition and distance to frontier. The parameter of the competition variable is positive and larger than the OLS estimators for the four innovation variables, suggesting that higher foreign competition increases innovation. However, the impact is not statistically significant for process innovation. This nonsignificance of foreign competition on process innovation is in keeping with the findings of the literature review of Shu and Steinwender (2018), who argue that trade liberalization and the consequent access to foreign inputs could substitute domestic process innovation and thus stifle innovation.[5]

In the case of the control variables, compared to the OLS estimation, the IV results show that the export variable is less significant but that the rest of the variables maintain their sign and statistical significance. In quantitative terms, the estimated impact of competition is very relevant, especially for the investment in R&D and product innovation. From table 4, column 4, we can deduce that an increase of one standard deviation in the competition variable (table 1) increases the probability of the firm investing in R&D by approximately 17 percentage points (0.139*1.2) compared with a sample average of 37%. In the case of product innovation, the results from table 4, column 2, indicate that the same increase in competition raises this probability by 11.2 percentage points (0.094*1.2). This is equivalent to about 15% of the sample average. Hence, our results indicate that foreign competition has a relevant, positive impact on innovation in LAC countries, especially for product innovation and investment in R&D.

In table 5, we show the results for the interaction between competition and distance to frontier. In table 6, to check the robustness of our results to potential nonlinearity in the relationship between productivity and competition, we introduce the interaction between competition and dummy variables according to the quartiles of the productivity distribution.[6] Both sets of results show that most of these interactions are not significant, indicating the absence of heterogeneous effects for foreign competition.[7]

To analyze the impact of traditional measures of concentration, we estimate the model including the Herfindahl-Hirschman Index (HHI) calculated with information from the surveys for each industry and country. We also include the interaction between foreign competition and the HHI to look at whether higher competition has a more pronounced impact on more concentrated markets. The evidence shown in table 7 suggests that concentration does not affect innovation indicators, with the exception of a positive impact on the probability of investing in R&D. We find that the interaction between foreign completion and HHI is not significant.

---

[4] We normalize each variable by subtracting the mean and dividing by the standard deviation.

[5] This negative impact may also happen because returns to innovation—for both process and product—may depend heavily on market size. In import-competing sectors, greater foreign competition may reduce the size of the market size that local firms face, therefore reducing innovation returns. For a more detailed discussion, see section 4 of Shu and Steinwender (2018).

[6] In the case of Argentina, Bustos (2011) finds that the impact of trade liberalization increases innovation for firms in the intermediate part of the productivity (size) distribution. We also try using size, but the results were unchanged.

[7] Unreported estimations, available upon request, confirm that the squared competition term is not significant, thus rejecting the inverted-U shape of the relationship between innovation and competition.

5. CONCLUSIONS

Several countries in Latin America have embarked on structural reforms that seek to enhance innovation and productivity growth, including by reducing both trade barriers and restrictions to foreign direct investment. However, the available evidence largely suggests that results have been disappointing for both factors. In this paper, we have analyzed whether foreign competition affects innovation in a sample of Latin American countries to look at whether or not the low innovative activity in these economies may be the result of a lack of competitive pressure, as argued by Lederman et al. (2014).

We find that higher foreign competition has a positive impact on diverse indicators of technological innovation. We are unable to find an inverted-U relationship of the type found by Aghion et al. (2005), which would indicate room to increase innovation by strengthening competition in product markets. In quantitative terms, the estimated impact of competition is extremely relevant. Our results indicate that an increase of one standard deviation in the competition variable increases the probability of investing in R&D by approximately 17 percentage points and the probability of introducing product innovation by 11.2 percentage points.

We conclude, first, that there is space for policies that contribute to increasing the innovative activity of Latin American firms by introducing more competition into product markets. However, there are differences from one country to the next. Given that barriers to trade and FDI restrictions are already low in countries such as Chile and Peru, new ways of lowering barriers to competition need to be thought up in those countries. Second, policymakers also need to think about how to strengthen the aggregate impact of microeconomic policies seeking to enhance innovation. The evidence so far suggests that the positive impact of innovation and technology programs have not affected aggregated indicators to a significant degree.

TABLE 1: DESCRIPTIVE STATISTICS

VARIABLES	Obs	Mean	Min	Max
Competition	2,885	2.5	1	4
		1.2		
Total innovation	2,885	0.62	0	1
		0.48		
Product innovation	2,885	0.59	0	1
		0.49		
Process innovation	2,881	0.51	0	1
		0.5		
Log (employment)	2,885	3.2	0	9.46
		1.42		
Export share	2,885	11.59	0	100
		24.5		
Import share	2,885	28.5	0	100
		32.1		
Distance to frontier	2,885	93.7	0	100
		11.9		
Share of skilled workers	2,885	0.61	0	15.56
		0.7		
Firm age	2,885	2.88	0	5
		0.8		
Domestic market	2,885	0.3	0	1
		0.46		

TABLE 2: DESCRIPTIVE STATISTICS BY COUNTRY

	Observations	Mean Comp	Mean Total Inn	Mean Product Inn	Mean Process Inn	Mean R&D
Argentina	518	2.249	0.606	0.757	0.669	0.508
Bolivia	269	2.245	0.621	0.732	0.729	0.44
Chile	529	2.51	0.582	0.696	0.667	0.339
Colombia	531	2.484	0.571	0.695	0.689	0.461
Mexico	779	2.67	0.258	0.335	0.303	0.158
Peru	255	2.761	0.714	0.835	0.807	0.588

TABLE 3: COMPETITION AND INNOVATION: OLS ESTIMATION

VARIABLES	(1) Product or Process	(2) Product	(3) Process	(4) R&D
Competition	0.031***	0.020***	0.024***	0.035***
	(0.008)	(0.007)	(0.008)	(0.007)
Size	0.056***	0.047***	0.049***	0.068***
	(0.007)	(0.007)	(0.007)	(0.007)
Exports	0.001*	0.001**	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Imports	0.001***	0.002***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Skill	0.040***	0.028**	0.046***	0.061***
	(0.013)	(0.011)	(0.012)	(0.013)
Age	-0.018	-0.010	-0.006	0.013
	(0.012)	(0.011)	(0.012)	(0.012)
Distance	-0.000	0.001	-0.000	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
Domestic	0.100***	0.097***	0.081***	0.087***
	(0.019)	(0.018)	(0.019)	(0.019)
Constant	58.061***	36.388***	2.171***	37.776
	(16.628)	(12.356)	(0.733)	(30.729)
Observations	2,881	2,881	2,878	2,871
R^2	0.166	0.199	0.189	0.210

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

TABLE 4: COMPETITION AND INNOVATION—IV ESTIMATION

VARIABLES	(1) Product or Process	(2) Product	(3) Process	(4) R&D
Competition	0.076*	0.094**	0.045	0.139***
	(0.045)	(0.042)	(0.043)	(0.044)
Size	0.052***	0.041***	0.047***	0.060***
	(0.008)	(0.007)	(0.007)	(0.008)
Exports	0.000	0.000	0.001**	0.001
	(0.001)	(0.000)	(0.000)	(0.001)
Imports	0.001***	0.001***	0.001**	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)
Skill	0.038***	0.025**	0.045***	0.056***
	(0.013)	(0.012)	(0.012)	(0.014)
Age	-0.022*	-0.016	-0.007	0.005
	(0.013)	(0.012)	(0.012)	(0.012)
Distance	-0.000	0.001	-0.000	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
Domestic	0.092***	0.084***	0.077***	0.070***
	(0.021)	(0.020)	(0.020)	(0.021)
Constant	66.137***	44.910***	53.158***	49.322
	(18.770)	(15.019)	(19.441)	(39.120)
Observations	2,881	2,881	2,878	2,871
R^2	0.156	0.170	0.186	0.154

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

TABLE 5: COMPETITION AND INNOVATION—IV HETEROGENEOUS EFFECTS

VARIABLES	(1) Product or Process	(2) Product	(3) Process	(4) R&D
Competition	-0.236	-0.416*	-0.119	-0.228
	(0.216)	(0.249)	(0.196)	(0.169)
Competition*Distance	0.003	0.006**	0.002	0.004**
	(0.002)	(0.003)	(0.002)	(0.002)
Size	0.050***	0.037***	0.046***	0.057***
	(0.008)	(0.008)	(0.008)	(0.008)
Exports	0.000	0.000	0.001**	0.001
	(0.001)	(0.001)	(0.000)	(0.001)
Imports	0.001***	0.002***	0.001**	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)
Skill	0.039***	0.027**	0.045***	0.058***
	(0.013)	(0.012)	(0.012)	(0.014)
Age	-0.021	-0.014	-0.007	0.007
	(0.013)	(0.012)	(0.012)	(0.012)
Distance	-0.009	-0.014**	-0.005	-0.012**
	(0.006)	(0.007)	(0.006)	(0.005)
Domestic	0.087***	0.075***	0.075***	0.064***
	(0.021)	(0.020)	(0.020)	(0.021)
Constant	67.290***	46.957***	53.850***	50.966
	(18.716)	(15.390)	(19.420)	(40.460)
Observations	2,881	2,881	2,878	2,871
R^2	0.146	0.141	0.183	0.143

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

TABLE 6: COMPETITION AND INNOVATION—IV HETEROGENEOUS EFFECTS

VARIABLES	(1) Product or Process	(2) Product	(3) Process	(4) R&D
Competition	0.292	0.212	0.127	0.298
	(0.221)	(0.302)	(0.317)	(0.205)
Competition*Productivity 2	-0.064	0.184	0.230	-0.100
	(0.260)	(0.253)	(0.253)	(0.225)
Competition*Productivity 3	-0.186	-0.192	-0.166	-0.120
	(0.309)	(0.415)	(0.439)	(0.283)
Competition*Productivity 4	-0.346	-0.250	-0.209	-0.233
	(0.237)	(0.298)	(0.308)	(0.215)
Size	0.069***	0.047***	0.051***	0.072***
	(0.016)	(0.016)	(0.016)	(0.014)
Exports	0.001	0.001	0.002**	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Imports	0.001**	0.002***	0.001*	0.001**
	(0.001)	(0.001)	(0.001)	(0.000)
Skill	0.039*	0.021	0.041	0.057***
	(0.020)	(0.023)	(0.025)	(0.018)
Age	-0.021	-0.022	-0.014	0.007
	(0.017)	(0.018)	(0.018)	(0.015)
Distance	-0.013	-0.012	-0.012	-0.009
	(0.008)	(0.010)	(0.011)	(0.008)
Domestic	0.141***	0.141**	0.132**	0.098**
	(0.046)	(0.055)	(0.057)	(0.042)
Constant	61.407	64.640	75.932*	41.087
	(42.668)	(42.715)	(44.623)	(56.938)
Observations	2,881	2,881	2,878	2,871

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

TABLE 7: COMPETITION, CONCENTRATION, AND INNOVATION—OLS RESULTS

VARIABLES	(1) Product or Process	(2) Product	(3) Process	(4) R&D
Competition	0.031***	0.020***	0.024***	0.036***
	(0.008)	(0.008)	(0.008)	(0.007)
HHI	0.234	0.256	0.243	0.715***
	(0.524)	(0.545)	(0.571)	(0.266)
Competition*HHI	-0.106	-0.159	-0.122	-0.187
	(0.156)	(0.164)	(0.172)	(0.116)
Size	0.056***	0.047***	0.049***	0.068***
	(0.007)	(0.007)	(0.007)	(0.007)
Exports	0.001*	0.001**	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Imports	0.001***	0.002***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Skill	0.040***	0.029**	0.046***	0.061***
	(0.013)	(0.011)	(0.012)	(0.013)
Age	-0.018	-0.010	-0.006	0.014
	(0.012)	(0.011)	(0.012)	(0.012)
Distance	-0.000	0.000	-0.000	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
Domestic	0.100***	0.097***	0.081***	0.087***
	(0.019)	(0.018)	(0.019)	(0.019)
Constant	59.060***	36.717***	1.889***	1.492
	(16.966)	(12.628)	(0.631)	(1.048)
Observations	2,881	2,881	2,878	2,871
R-squared	0.166	0.199	0.189	0.210

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

REFERENCES

Aghion, P., Bloom, N., Blundell, R., Griffith, R. and Howitt, P. 2005 "Competition and Innovation: An Inverted U Relationship." *Quarterly Journal of Economics* 120(2): 701–728.

Álvarez, R., and Robertson, R. 2004. "Exposure to Foreign Markets and Plant-Level Innovation: Evidence from Chile and Mexico." *The Journal of International Trade and Economic Development* 13(1): 57–87.

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

Autor, D., Dorn, D., Hanson, G.H., Pisano, G., and Shu, P. 2016. "Foreign Competition and Domestic Innovation: Evidence from US Patents." National Bureau of Economic Research Paper No. w22879.

Bloom, N., Draca, M., and Van Reenen, J. 2016. "Trade-Induced Technical Change? The Impact of Chinese Imports on Innovation, IT, and Productivity." *The Review of Economic Studies* 83(1): 87–117.

Bustos, P. 2011. "Trade Liberalization, Exports, and Technology Upgrading: Evidence on the Impact of MERCOSUR on Argentinian firms." *American Economic Review* 101(1): 304–40.

Cole, H.L., Ohanian, L.E., Riascos, A., and Schmitz Jr, J.A. 2005. "Latin America in the Rearview Mirror." *Journal of Monetary Economics* 52(1): 69–107.

Correa, J. 2012. "Innovation and Competition: An Unstable Relationship." *Journal of Applied Economics* 27: 160–166.

Crespi, G., and Katz, J. 1999. "R&D Expenditure, Market Structure and 'Technological Regimes' in the Chilean Manufacturing Industry." *Estudios de Economía* 26(2): 163–186.

De Elejalde, R., Ponce, C., and Roldán, F. 2018. "Innovation and Competition: Evidence from Uruguayan Firms." Documento de Investigación nro. 116, Universidad ORT Uruguay, Facultad de Administración y Ciencias Sociales.

Fernandes, A.M., and Paunov, C. 2013. "Does Trade Stimulate Product-Quality Upgrading?" *Canadian Journal of Economics* 46(4): 1232–1264.

Gorodnichenko, Y., Svejnar, J., and Terrel, K. 2010. "Globalization and Innovation in Emerging Markets." *American Economic Journal, Macroeconomics* 2(2): 194–226.

Hashmi, A. 2013. "Competition and Innovation: The Inverted-U-Relationship Revisited." *Review of Economics and Statistics* 95(5): 1653–1668.

Inter-American Development Bank. 2010. *The Age of Productivity. Transforming Economies from the Bottom Up.* Washington, DC: Palgrave Macmillan.

Krasniqi, B.A., and Kutllovci, E.A. 2008. "Determinants of Innovation: Evidence from Czech Republic, Poland and Hungary." *International Journal of Technoentrepreneurship* 1(4): 378–404.

Lederman, D., Messina, J., Pienknagura, S., and Rigolini, J. 2013. "Latin American Entrepreneurs: Many Firms but Little Innovation." World Bank Publications.

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.

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.

Shu, P., and Steinwender, C. 2018. "Innovating in a Global Economy." Mimeo, Georgia Institute of Technology and MIT.