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Matteo Grazzi, Carlo Pietrobelli and Adam Szirmai

Maastricht Economic and social Research institute on Innovation and Technology (UNU-MERIT)
email: info@merit.unu.edu | website: http://www.merit.unu.edu

Maastricht Graduate School of Governance (MGSoG)
email: info-governance@maastrichtuniversity.nl | website: http://mgsog.merit.unu.edu

Keizer Karelplein 19, 6211 TC Maastricht, The Netherlands
Tel: (31) (43) 388 4400, Fax: (31) (43) 388 4499

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The Performance of Firms in Latin America and the Caribbean: Microeconomic Factors and the Role of Innovation

Matteo Grazzi
Inter-American Development Bank, Washington D.C.
matteog@iadb.org

Carlo Pietrobelli *
Inter-American Development Bank, Washington D.C., and University Roma Tre, Italy
carlop@iadb.org

Adam Szirmai
UNU-MERIT
szirmai@merit.unu.edu

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Abstract

The low productivity of Latin American and Caribbean economies has been acknowledged as a serious problem that calls for detailed analyses and appropriate and timely responses. However, in addition to macroeconomic and regulatory factors, productivity depends crucially on microeconomic aspects and on the specific strategies and decisions of individual firms. Such microeconomic decisions have been seldom studied in a quantitative and comparative manner. This paper addresses this gap in the literature.

The paper presents the results of recent original microeconomic evidence, showing that innovation significantly influences the productivity of firms, although to different degrees depending on the characteristics of the firms. Moreover, the evidence confirms that the impact of innovation on productivity depends also on additional complementary assets, such as access and use of ICT and on-the-job training. Our analysis reveals that these conclusions also hold true for the Caribbean economies, traditionally understudied. Additional factors that can influence productivity have also been detected, such the age of firms, their access to credit and finance, and their participation in international markets and global value chains. The paper concludes by stating that a thorough understanding of these complex phenomena and their interrelations is an essential condition for the design of more effective public policies.

JEL Codes: D22; O3 O12

Keywords: Latin America and Caribbean, Firm Productivity, Research and Development, Innovation, ICT, Microeconomic factors

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Introduction

After a decade of relatively strong economic performance, growth in Latin America and the Caribbean (LAC) has begun to taper off. This slowdown in the region is significantly alarming in the long term, especially in face of the efforts to keep up with developed countries and the need to maintain the pace with other emerging economies. The question is whether this downward trend is due to the prevailing macroeconomic and sectorial frameworks that exist in LAC or whether it is the result of specific characteristics, such as the behaviour of private sector firms in the region.

During the last 50 years, the per capita income of LAC has stagnated relative to that of the United States, while the per capita income of East Asian countries[1] has grown steadily since 1960—to reach a level that is almost half of that of the United States. Moreover, the LAC region remains one with little structural diversity and is increasingly dependent on natural resources. Today, commodities constitute approximately 60% of LAC's exports, compared with less than 40% at the beginning of the 2000s (OECD, 2014). The current fall in commodity prices, therefore, is expected to further hinder LAC's economic performance in the near future. Together, these developments raise various questions, such as the reasons behind LAC's disappointing performance; how other regions have been able to develop so much more rapidly; and whether firms are responsible for the poor results.

Applying standard growth accounting techniques, growth of GDP per capita can be divided into factor accumulation (growth of capital and labour inputs) and growth of output per unit of input (total factor productivity, among others driven by technological progress). Estimates for LAC provide clear evidence that, despite years of rising factor accumulation, slow productivity growth[2] should be considered the root of LAC's weak overall performance (Crespi, Fernández-Arias, and Stein, 2014; Daude and Fernandez-Arias, 2010; Pagés, 2010). Between 1960 and 2011, GDP per capita in LAC grew at 1.79% per year, slightly below the rate of the United States over the same period. In terms of factor accumulation, the region outpaced the United States. Total factor productivity (TFP) in the United States, however, grew 1.21% while it stagnated in LAC, more than compensating for the higher rate

1 The East Asian countries considered in this analysis include Hong Kong, Malaysia, Singapore, South Korea, and Thailand (World Development Indicators at http://data.worldbank.org/data-catalog/world-development-indicators, accessed November 2014).

2 Productivity is measured in multiple ways, with labour productivity and total factor productivity (TFP) being two of the most common measures. What is important is to note that performance across LAC remains consistently low across both measures in comparison to other regions, worldwide. Labour productivity in Latin America, for example, grew by 0.9 percent per annum between 1990 and 2014, compared to 1.6 percent, 8.1 percent, and 2.9 percent, respectively, for the United States, China, and Developing Asia (including Bangladesh, Cambodia, Indonesia, Malaysia, Pakistan, Philippines, Sri Lanka, Thailand, and Vietnam) (The Conference Board at https://www.conference-board.org/data/economydatabase/, accessed in January 2014). The same trend emerges when applying TFP, as in Table 1.

of factor accumulation there. Weak TFP performance can thus be assumed to be the basis for LAC's inability to keep abreast with U.S. GDP per capita (Table 1).

Table 1. Growth Accounting: Latin America and The Caribbean versus Comparison Countries, 1960–2011 *(in%)*

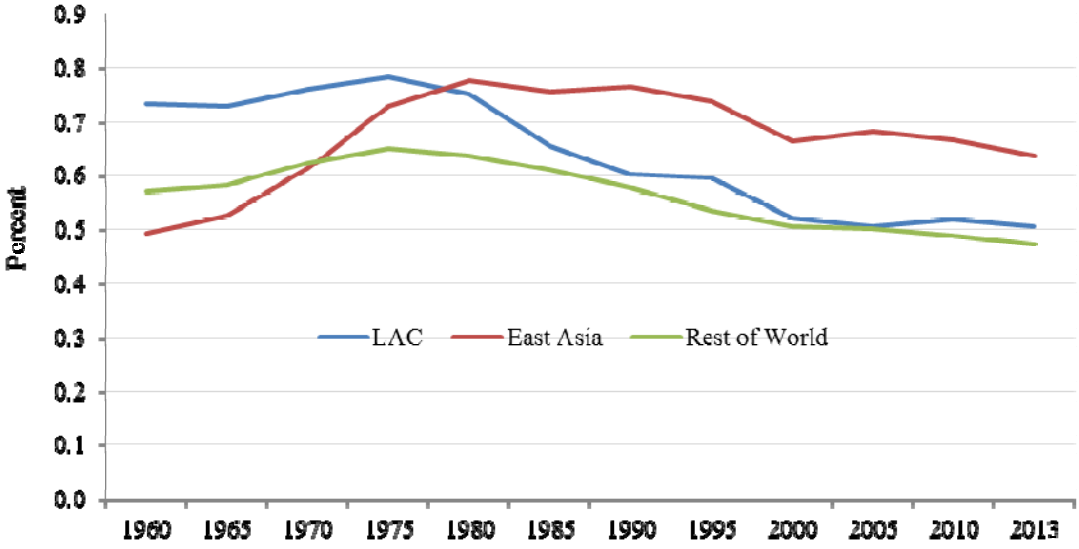
Country/ Region	GDP per capita	Factor Accumulation	TFP	% Share
Average	*(a)*	*(b)*	*(c)*	*(c) / (a)*
Latin America & Caribbean	1.79	1.80	-0.01	-0.006
East Asia/Pacific	3.69	2.85	0.83	22.5
United States	1.99	1.21	0.78	39.2
China	6.04	4.21	1.83	30.3
Finland	2.74	1.44	1.30	47.4

Source: Authors' elaboration on data from Penn World Table 8.0.

Notes: The countries of Latin America and the Caribbean (LAC) include Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Honduras, Jamaica, Mexico, Panama, Paraguay, Peru, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay, and Venezuela. The East Asia and Pacific countries are: Australia, Brunei, Cambodia, China, Fiji, Hong Kong, Indonesia, Japan, Laos, Macao, Malaysia, Mongolia, New Zealand, Philippines, Singapore, South Korea, Thailand, and Vietnam. Physical capital and human capital are considered as productive factors in the production function.

The weak TFP performance of LAC starkly contrasts with those countries that were at a similar level of development in 1960 but which, since then, have been able to converge to the U.S. level of performance. In Finland, for example, TFP increased from 50% to 69% of that of the United States over the last 40 years, while in South Korea it grew from 20% to 63% during the same period. Overall, the East Asian economies were successful in boosting total factor productivity relative to that of the United States from 49% in 1960 to 78% in 1980. Following some decline, these economies stood at 64% in 2013 (Figure 1). The LAC scenario is the reverse in that between 1960 and 2011, GDP growth per capita was sustained only by factor accumulation rather than by TFP growth, and productivity declined from 73% of U.S. TFP in 1960 to 51% in 2013.

Figure 1. Total Factor Productivity Relative to the United States. 1960–2013



Source: Authors' elaboration on data from Fernandez Arias (2014)

This evidence is consistent with the hypothesis that economic growth, based on factor accumulation, is subject to diminishing returns and that successful catch-up requires fast productivity growth (Easterly and Levine, 2001; Hall and Jones, 1999; Klenow and Rodriguez-Clare, 1997). The fact that LAC countries have not been able to significantly increase their productivity is a source of serious concern. This, indeed, leads us to investigate the reasons for weak productivity performance.

There is a plethora of research studies that address this key issue, especially during recent years (Syverson, 2011). Many studies have used macroeconomic data to estimate aggregate production functions obtaining results similar to those discussed above. Ultimately, however, the economic performance of a country or sector will depend on decisions made at the level of the firm. This should explicitly be taken into account. A disaggregated enterprise-level approach is necessary in order to obtain a better understanding of the dynamics underlying different patterns of productivity growth (Foster, Haltiwanger, and Krizan, 2001). Macroeconomic data is useful to describe the aggregate phenomena; however, it can tell us little about the underlying microeconomic behaviour that drives this dynamic. To address these issues, some researchers introduced the microeconomic dimension into the analysis, showing that productivity growth is essentially

driven by two principal factors: reallocation of resources between firms and efficiency improvements within firms (Dollar et al., 2005; Bergoeing and Repetto, 2006).[3]

The first factor relates to the reallocation process between firms, which is only possible when resources can be easily allocated to different activities within the presence of smoothly functioning markets (Busso, Madrigal, and Pagés, 2013). In this context, competitive pressures generate Schumpeterian processes of creative destruction, within sectors and across sectors. In the latter case, this process is expected to reshape economies towards more productive structures by shifting resources from less to more productive sectors. In recent years, this does not appear to have occurred in LAC in recent years, leading McMillan, Rodrik, and Verduzco-Gallo (2014) to conclude that during the period 1990–2005, LAC experienced significant productivity gains within the same sectors, but displaced workers from the least productive firms found themselves operating in less productive activities. "In other words, rationalization of manufacturing industries may have come at the expense of inducing growth-reducing structural change."

The second factor relates to efficiency improvements within the firm. Such efficiency gains occur as a result of firm-specific behaviour and strategies, due to reactions to different market incentives faced by the firms or to differences in characteristics, management practices, internal organization, or technological capabilities of the firms (Williamson, 1973, Dosi, 1988, Teece and Pisano, 1994).

Both factors need to be examined with a view to explaining LAC's poor productivity performance during recent years. While the first factor (i.e., reallocation of resources across firms and sectors) has been studied by several authors (e.g., Hsieh and Klenow (2009) and Busso, Madrigal, and Pagés (2013)), analysis of the second factor — productivity improvements within firms — is very scant. This paper addresses this gap in the literature and explores how the different patterns of microeconomic behaviour may have impacted on productivity in the LAC region.

This paper presents a synthesis of the findings of a collection of original papers contained in a forthcoming IDB publication *Innovation and Productivity in Latin American and Caribbean Firms* (Grazzi and Pietrobelli, forthcoming 2016). These papers all use data from

3 The literature has recognized the importance of both factors in explaining productivity growth rates. Pagés (2010) establishes that the two factors were key to explaining the productivity gains that occurred during the period 1990–2005 in East Asia.

the World Bank Enterprise Survey (WBES),[4] as well as from additional data sources, making the case that a firm-level approach is necessary to understand the dynamics of productivity. Specifically, explanations of productivity related to within-firm decisions and behaviour are sought. Section 2 discusses the finding that innovation contributes to a firm's productivity improvements, but that complementary assets (i.e., ICT adoption and on-the-job training) are also essential to achieve better performance. Section 3 provides an in depth analysis of firm behaviour, resulting in two complementary propositions: (i) there is a remarkable degree of heterogeneity in productivity across firms, even within the same sectors, and (ii) productivity returns to innovation efforts are far from homogeneous and differ substantially, depending on firm characteristics. Next, Section 4 argues that, although innovation plays a central role, it is not the only relevant factor explaining the productivity performance of firms. Other factors require consideration as well. These include access to finance, as well as participation in international markets through exports, foreign direct investment, and Global Value Chains (GVC), significantly affect productivity. Section 5 briefly discusses the policy implications of our analysis. Section 6 concludes.

Innovation and Productivity

The theoretical consensus on the positive relationship between research and development (R&D), innovation, and productivity at the firm level is widespread (Griffith et al., 2006; OECD, 2009; Mairesse and Mohnen, 2010; Mohnen and Hall, 2013). Most of this literature, however, refers to advanced economies, while research relating to developing countries is still somewhat limited. The question is whether this relationship also holds true for the countries in the LAC region and it is affected by other factors. Does innovation require complementary resources such as, for example, the adoption of information and communications technology (ICT) and on-the-job training to produce the effects on productivity?

For a long period of time, evidence for Latin America has been inconclusive with regard to the ability of firms to transform R&D into innovations and the impact of innovation on productivity. For example, Chudnovsky, López, and Pupato (2006) and Raffo, Lhuillery, and Miotti, (2007) found that more investment in knowledge, in the case of Argentina and Brazil, increased the probability of introducing technological innovation in firms. Evidence

4 World Bank Enterprise Surveys (WBES) data is available for over 130,000 firms in 135 countries (http://www.enterprisesurveys.org, accessed on May 29, 2015). The WBES collects survey information through face-to-face interviews with firm managers and owners regarding the business environment in their respective country and the productivity of their firms, including questions that relate to infrastructure, sales and supplies, competition, crime, corruption, finance, business development services, business-government relations, labour, and firm performance. The IDB financed the 2010 wave of WBES Surveys in 14 Caribbean countries, marking the first time the Caribbean region was included. Furthermore, the IDB financed the inclusion of additional questions for all surveys in Latin America regarding the key issues that firms face within the region, including questions related to innovation, business development services, and workforce training for human capital.

from Chile (Benavente, 2006) and Mexico (Perez, Dutrénit, and Barceinas, 2005), however, does not confirm this relationship. Similarly, with respect to the impact of innovation on productivity, Raffo, Lhuillery, and Miotti (2007) found positive effects in the case of product innovation in Brazil and Mexico, but not in Argentina. Chudnovsky, López, and Pupato (2006) and Benavente (2006) found no significant impacts on productivity in Argentina and Chile.

The different results in the various countries may be caused by the lack of homogenous and comparable data across Latin America. Indeed, innovation surveys in the region differ in their sampling methodologies, questionnaire designs, and empirical strategies, which can actually affect the comparability of results.[5] In 2012, the IDB produced a research paper (Crespi and Zuñiga, 2012) that represented a first effort to examine the determinants of innovation and their impact on firm productivity, by employing the same specification and identification strategy on data from innovation surveys in six LAC countries. Their results proved to be more consistent than previous attempts, showing that (i) firms that invest in knowledge are more likely to introduce technological innovations and (ii) firms that innovate are more productive than those that do not.

Two recent empirical studies—one focused on Latin America (Crespi, Tacsir and Vargas, 2016) and the other on the Caribbean (Mohan, Strobl and Watson, 2016)—made a further step towards exploring the relationships between innovation efforts, innovation outputs, and productivity in LAC. In fact, the innovation module of the 2010 WBES makes it possible to apply a common methodology on a pooled dataset, collected with the same questionnaire and sampling from 17 Latin American countries and 14 Caribbean countries. The availability of the information relating to the Caribbean is particularly valuable since, to date, little is known about the performance of firms in this area—and even less is known of their attitude towards innovation. This dearth of information is due mainly to the lack of reliable data for the Caribbean.

In terms of the analytical framework, Crespi, Tacsir and Vargas (2016) and Mohan, Strobl and Watson (2016) build on the structural model that was first developed by Crepon, Duguet, and Mairesse (1998), referred to as the Crepon/Duguet/Mairesse (CDM) model, but with some variances in its empirical application. This new model provided a fresh perspective which became a more popular model compared to the previous ones which assumed the direct relationship between R&D efforts and productivity, given that R&D is a necessary—although not sufficient—condition to enhance productivity. The CDM model

5 In this respect, the IDB, together with the Latin-American Network of Scientific and Technological Indicators (Red Ibero-Americana de Indicadores de Ciencia y Tecnología (RICYT)), has emphasized the need to develop comparable innovation surveys. Recommendations have been put forward with regard to sample design, data collection, and harmonization of questionnaires, based on existing manuals (Anlló et al., 2014). Based on these recommendations, the IDB—in recent years—has financed the cost of innovation surveys in several LAC countries.

considers that it is not the input of innovation (R&D) that increases productivity; rather, it is the output of innovation that increases it. Through a causal model, the authors thus proposed a set of equations to capture the entire process—from the R&D stage to the productivity level. That is, firms invest in research to develop innovations, which in turn may contribute to productivity and other economic performances (Crepon, Duguet and Mairesse, 1998).

The CDM model is structured in three stages. The first represents the analysis that focuses on the decision to engage in innovation expenditure. The second stage is an innovation function where subjective indicators of product and process innovation are related to innovation expenditures and other explanatory variables.

The key issue with regard to these first two steps is how to measure innovation investment. In most of the literature relating to developed countries, the amount of R&D expenditure has been considered the most favourable indicator, due to its role in the mechanism that leads to the creation, adaptation, and adoption of new ideas and technological applications (Griffith et al., 2004). In the context of emerging countries, however, it is useful to apply a broader concept of innovation investment, which also includes capacity training and investment in technology transfer (Crespi and Zuñiga, 2012). In fact, an emphasis on R&D expenditure—without taking into account other innovation inputs—may lead to an underestimation of the role played by other forms of investment that may be equally, or even more, important for innovation in those countries where the cost of R&D is high and firms are far from the technological frontier. This, in particular, is true for the Caribbean countries, where the percentage of firms that engage in formal R&D is extremely limited.[6] Mohan, Strobl and Watson. (2016), therefore, employ a broader definition of innovation investment that includes not only R&D, but also includes the cost of intellectual property rights, including patents, trademarks, industrial designs, copyrights, and/or specialized consultancy services. Crespi, Tacsir and Vargas (2016), on the other hand, do apply R&D investment to their study.

The third and final stage of the CDM model represents a focus on the effects of innovation performance on labour productivity. This relationship is assessed in the context of a standard Cobb Douglas production function with constant returns to scale, where innovation performance is added to capital and labour inputs. This provides an estimate of the productivity returns as a result of innovation.

Overall, the results of both studies substantially confirm the previous findings of Crespi and Zuñiga (2012). Firstly, LAC firms are more likely to introduce product or process innovation if they invest more in innovation. More specifically, the innovation performance in

6 In the Caribbean, only 8 percent of firms carry out R&D, compared with 43 percent in Latin America.

LAC firms is strongly influenced by the amount of R&D. In Latin America, a 10 per cent increase in R&D spending on average results in a 1.7% increase in the probability of a firm innovating, a 10 per cent increase in innovative sales results in a 1.3% increase in the probability of innovation. R&D spending (especially on product innovation) also increases the likelihood of a firm applying for intellectual property rights protection. In the Caribbean, based on a slightly different method, a unit increase in the log of innovation expenditure per employee will increase the probability of innovation by 56%. The significance of the relationship is confirmed, and the effect is higher than that found for all the Latin American countries included in Crespi and Zuñiga (2012), with the exception of Chile. Ultimately, spending on innovation has higher returns in terms of product innovation in the Caribbean than in most Latin American countries.

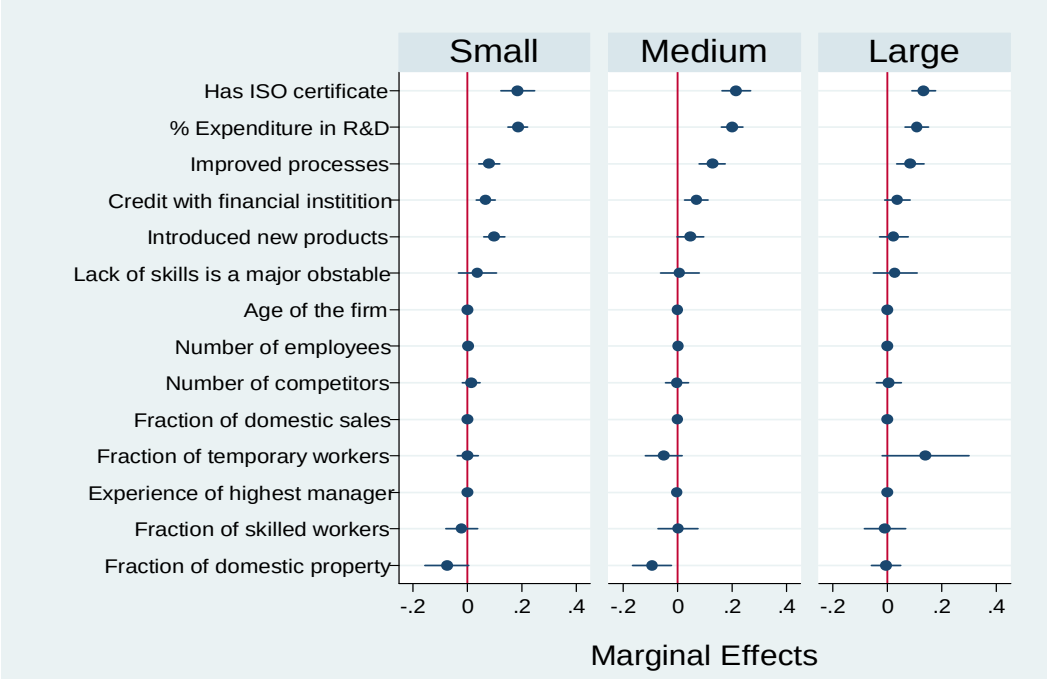
Secondly, innovation has a significant effect on productivity performance in the LAC region. The labour productivity of firms that are innovative is on average, 50% higher than that of firms that do not engage in innovation. In the Caribbean, the estimated elasticity is 0.63. If a comparison is made of this latter result with the coefficients found in Crespi and Zuniga (2012), it is higher than for Argentina, Chile, and Costa Rica, although it is substantially lower than for Colombia, Panama, and Uruguay. The variation in the magnitude of effects of innovation on productivity suggests that this relationship is strongly influenced by differences in national characteristics, including differences in national systems of innovation.

Furthermore, the results from Crespi, Tacsir and Vargas (2016) clearly demonstrate that the mechanisms leading to innovation, as well as the impacts of innovation performance on the economic performance of firms vary significantly with the capabilities and characteristics of the firms. On the one hand, some factors such as firm size, product diversification, and fixed investment) are important determinants of innovation outputs in their own right, beyond the influence of increased R&D investment. On the other hand, human capital affects the intensity of R&D investment positively, although it does not significantly affect innovation performance, suggesting that though complex, the relationship between human capital and innovation performance is an important one. Among the various complementary assets that can influence the relationships between innovation investment, innovation outcomes, and labour productivity, human capital and on-the-job training are clearly of major importance. A recent research paper by González-Velosa, Rosas, and Flores (2016) uses 2006 and 2010 WBES data for 11 countries to explore this relationship. It estimates a probit model of the determinants of the training decisions of LAC firms. The results, presented in Figure 2, speak for themselves. Regardless of firm size, the decision of LAC firms to train their employees is associated with various measures of

innovation and technological development, such as R&D investment, improved processes, certificates of International Organization for Standardization (ISO), and the introduction new products. The demand for more skilled workers depends on innovation.

In particular, the probability of providing training increases by 18percentage points if a firm's R&D expenses increase by 1%, and by 10percentage points if the firm has changed or improved its production processes in recent years. In such cases, innovation has an indirect influence on productivity through training decisions. Interestingly, there is little difference between the marginal effects of the variables that measure innovation in products and innovation in processes, despite the literature stating that these may have differential effects on the demand for skills and on employment. For example, recent evidence for LAC shows that product innovation may be more complementary to skilled than to unskilled labour (Crespi and Tacsir, 2012).

Figure 2. Determinants of the Decision to Train in Latin America



Source: González-Velosa, Rosas, and Flores (2016).
Notes: This figure illustrates the results of probit models estimated with WBES data. The training variable is constructed from the question, "Over fiscal year X, did this establishment have formal training programs for its permanent, full-time employees?" where X is the reference year of the survey (2006 or 2010). Country dummy variables were also included.

In the modern economy, ICT is often indicated as a key factor to enable the development of new processes and new work practices within a firm. Thus, ICT may facilitate substantial firm restructuring, making internal processes more flexible and practical, and reducing capital requirements through better equipment utilization and inventory reduction. Furthermore, the adoption of ICT opens external communication channels with

suppliers, clients, and other firms, thus facilitating not only coordination, but also the exchange of knowledge.

Relevant empirical research in Latin America, however, has been scarce and fragmented. Using 2010 WBES data for 19 LAC countries, Grazzi and Jung (2016) contribute to bridging this gap by exploring the rate of broadband adoption across the region as well as the relationship between innovation and broadband adoption. Employing a bivariate recursive probit model, they consider not only the effect of technology adoption on the innovation performance of firms (i.e., product and process innovation), but also the impact of the degrees of the exploitation of broadband potential, measured by the intensity of use in specific broadband activities.[7]

Table 2. Innovation and Broadband in Latin America

Variables	Product innovation		Process innovation	
	(1)	(2)	(3)	(4)
Broadband adoption	0.214***	0.064	0.255***	0.094**
	(0.036)	(0.044)	(0.039)	(0.047)
Internet use for purchases		0.016		0.019
		(0.019)		(0.020)
Internet use to deliver services		0.013		0.038*
		(0.020)		(0.020)
Internet use for research		0.112***		0.105***
		(0.020)		(0.021)
Internet for purchases + Delivery of services + Research		0.060**		0.048*
		(0.024)		(0.025)
Log Likelihood	-4,929.68	-4,868.86	-5,017.95	-4,961.54
Rho	-0.170**	-0.145**	-0.269***	-0.242***
	(0.067)	(0.067)	(0.071)	(0.072)
/athrho	-0.172**	-0.146**	-0.276***	-0.247***
	(0.069)	(0.069)	(0.076)	(0.077)
Observations	5,930	5,930	5,926	5,926

Source: Grazzi and Jung (2016)

Notes: Estimated average marginal effects from bivariate probit estimations; Delta method standard errors in parentheses;
* Significant at 10%. ** Significant at 5%. *** Significant at 1%.

The results contained in Table 2 clearly indicate that broadband is a key component of the innovation process; it also indicates that access to it alone offers a potential avenue to more innovation. Indeed, broadband communication needs to be used correctly in order to derive its full benefits. Firms can use broadband for various purposes: purchases, delivery services, and/or research. First and foremost, the use of the Internet to perform research is

[7] Intensity of use in specific broadband activities is measured as a set of dummies for different types of use.

positively and significantly related to innovation, rather than its use for other purposes. Secondly, the broader the variety of activities for which broadband is used, the greater its impact on innovation in addition to the purpose for research. The combined application of broadband for various activities has also been found to have an additional direct and positive effect on labour productivity, thus reinforcing the conclusion that technology needs to be used appropriately to exploit its full potential.

In sum, the quantitative evidence that is discussed above shows that there is a positive and significant relationship between firm-level investment in R&D and innovation and the results of innovation which, in turn, influence productivity. The relationship, however, is complex, with other factors that affect it, such as on-the-job training and access and use of ICTs, as in the case of broadband.

The Returns to Innovation: Not the Same for All

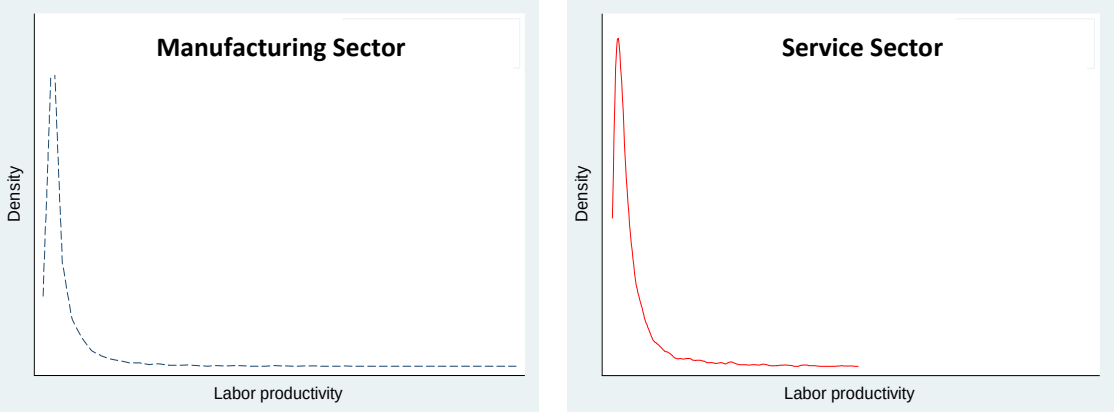
The results presented in the previous section refer to the typical LAC enterprise, reflecting firms as homogeneous and similar to each other. Empirical evidence, however, indicates that there is significant heterogeneity among enterprises that have different productivity levels and which coexist in the economy, even within the same sectors. As a consequence, the use of averages may obscure interesting differences between firms, illustrating significantly differing realities.[8]

For example, Syverson (2011) discovered that of the industries within the same four-digit Standard Industrial Classification (SIC) code in the manufacturing sector in the United States, the plant in the 90th%ile of the productivity distribution produces almost twice as much output with the same measured inputs as the plant in the 10th%ile. Even larger variation in productivity performance was recorded in China and India, TFP in the 90th%ile on average five times as high as in the 10th%ile (Hsieh and Klenow 2009). Evidence from LAC is consistent with these findings. Overall, the region is characterized by large disparities in productivity (Busso, Madrigal, and Pagés, 2013; and Pagés, 2010), with many low-productivity firms coexisting with few firms with high productivity (Lavopa, 2015). Using the WBES data for LAC, it is found that the ratio between the labour productivity in the 90th and 10th%iles in manufacturing is approximately 10:1. In Figure 3, this pattern is apparent for the manufacturing and service sectors. Most firms are clustered at very low levels of productivity, although there are also some highly productive firms. It is interesting to note

8 See, for example Caves (1998); Bartelsman and Doms (2000); Bartelsman et al. (2013); OECD (2001); and Crespi (2006).

that the distribution for the manufacturing sector appears to be more skewed than for the service sector,[9] with the tail extending much further to the right side in the graph.

Figure 3: LAC Productivity Distributions, 2010



Source: Authors' elaboration using WBES.

Dualism is a phenomenon that is frequently encountered in developing countries. LAC is no exception. From a theoretical point of view, this situation has been explained in various forms by scholars from different schools of thought. On the one hand, the neoclassical approach stresses the role of market incentives and, in general, the macroeconomic context that induces firms to behave differently in response to varying prices. Heterogeneity is the result of market imperfections, as a result of which inefficient firms are not forced to exit the market (e.g., Busso, Madrigal, and Pagés, 2013). On the other hand, evolutionary and managerial approaches refer to differences in the intrinsic characteristics of firms—their internal organization, routines and practices, specific strategies to accumulate technological capabilities, learning, and innovation (Williamson, 1973 and 1985; Dosi, 1988; Lundvall, 1992; Nelson and Winter, 1982; and Nelson, 1991). Lall (1992), for example, suggests that the development of firm capabilities is the result of the interplay between a "complex interaction of incentive structures with human resources, technological effort and institutional factors." Meanwhile, the dynamic capabilities approach, advanced by Teece and Pisano (1994), argues that the strategic resources at the disposal of the firm range from managerial and organizational processes, their present position, and the paths available to them. These approaches attribute firm performance to the unique characteristics embedded within firm-specific decision making, organization, and processes.

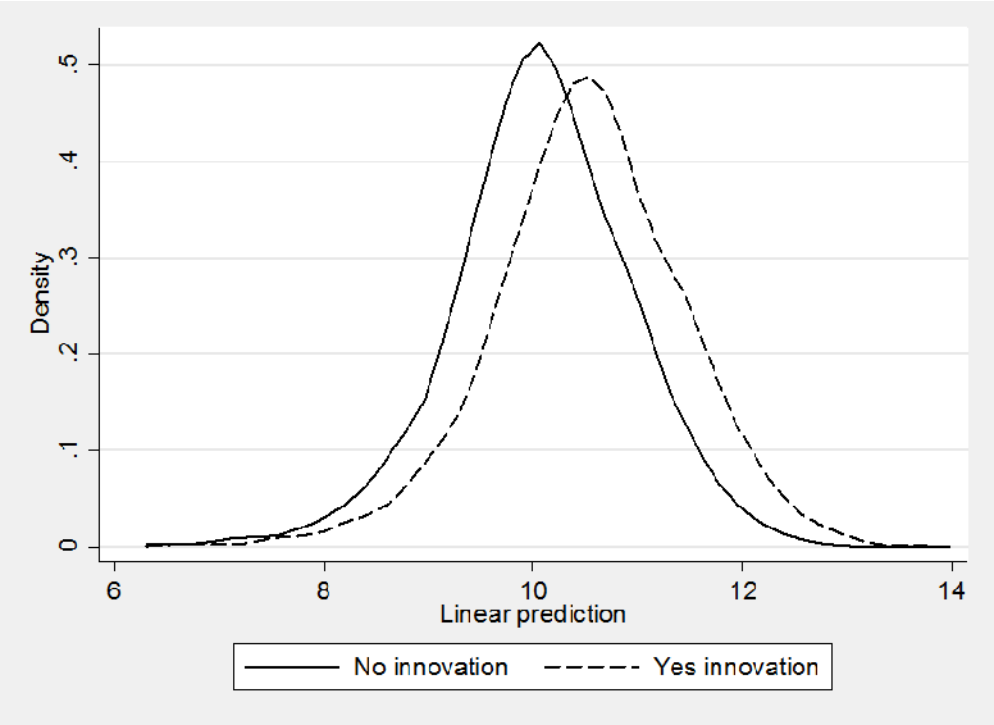
9 The skewness of a probability distribution measures its level of asymmetry. In this case, this means that the distribution of labour productivity in the manufacturing sector is more asymmetric than in the service sector.

Foster, Haltiwanger, and Krizan (2001) assert that the magnitude of within-sector heterogeneity implies that firm-specific factors determine whether firms achieve rapid productivity growth or suffer productivity declines. They cite such factors as uncertainty of demand for the firm's products, managerial ability, nature of installed capital, upgrading capabilities, location, and diffusion of knowledge concerning new technologies. For example, uncertainty over market demand and profitability may lead to experimentation by firms in which they seek to discover which technologies or processes best meet local market conditions (Jovanovic, 1982; Ericson and Pakes, 1989). Firm-level productivity will be affected by the success of such experimentation, whereby firms that have developed or acquired efficient technologies and know-how are able to put them to work. Doing so will have imminent effects on productivity levels, while those firms still experimenting how to most efficiently utilize their inputs may suffer from low productivity.

There is an additional dimension of heterogeneity that needs to be discussed here, which refers to variations in the impacts that innovation can have on productivity. Thus, if the heterogeneous population of Latin American firms is considered, it may well be that the positive relationship between innovation and productivity that we have just confirmed on the basis of the available evidence, also varies depending on the characteristics of the firms. Recent empirical tests appear to confirm this hypothesis. By simulating the productivity distributions of Latin American firms with and without innovation (Figure 3), the entire distribution of productivity shifts to the right when innovation occurs. This is consistent with a significant positive impact, on average. The spread of the distribution, however, is higher when innovation takes place, suggesting that the productivity impacts of innovation are not uniform across firms but vary substantially according to where the firm is located along the productivity distribution.

This result is confirmed by a second exercise (Table 3) where, by applying a quantile regression approach, it is clear that the impact of innovation on productivity is remarkably different across productivity quartiles. In other words, innovation has much larger effects on the firms that are already more productive than others. At the upper end of the distribution (the top 10% in terms of productivity), the increase in productivity due to innovation is much higher than in the lower quartiles (an increase of no less than 65% versus 29–34% in the first three quartiles). The strongest effects of innovation are found among the most productive firms.

Figure 3. The Heterogeneous Impacts of Innovation on Productivity in Latin American Firms



Source: Crespi, Tacsir, and Vargas (2016).

Table 3. The Heterogeneous Impacts of Innovation and Human Capital in Latin America

	Labour Productivity Ln(Q/L)				
	Q10	**Q25**	**Q50**	**Q75**	**Q90**
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Innovation	0.333***	0.298***	0.300***	0.384***	0.656***
	(0.0724)	(0.0546)	(0.0559)	(0.0964)	(0.1981)
Human Capital	0.1708***	0.2500***	0.3970***	0.6177***	0.7661***
	(0.0445)	(0.0399)	(0.0494)	(0.0740)	(0.1107)
N	4376	4376	4376	4376	4376

Source: Crespi, Tacsir, and Vargas (2016).
Notes: Standard errors in parentheses.
*, **, *** are coefficients that are statistically significant at the 10%, 5%, and 1% level, respectively. No asterisk means the coefficient is not different from zero with statistical significance.

Interestingly, similar differences in coefficients between the bottom and the top of the distribution can also observed with respect to human capital. Thus, while the premium for having a more educated workforce is 17% for firms at the bottom end of the distribution, it grows to almost 77% for firms at the top. This result is consistent with the findings of González-Velosa, Rosas, and Flores (2016) regarding the relationship between on-the-job-training and productivity in LAC enterprises. In fact, training is found to have a significant positive effect only in large manufacturing firms: a 1% increase in the proportion of trained

employees would raise productivity by 0.7%, but only in firms with more than 100 employees. If larger firms have a more skilled workforce and skilled workers receive much more training than unskilled workers, diverging productivity trajectories are bound to emerge.

Beyond Innovation: Other Factors that also Matter

Further extending the reasoning on heterogeneity across firms, recent evidence suggests that their performance is the result of multiple combined factors that mutually reinforce each other (Grazzi and Pietrobelli, 2016). Innovation clearly plays a positive and significant role in the productivity of firms, although together with other factors and complementary assets. Among these factors, it is worth mentioning the age of the firms, their access to credit markets, and their openness to international relations through, for example, exports, foreign direct investments, and participation in GVCs. Due to all these dimensions, inter-firm differences in productivity and in other aspects of performance continue to increase. This section presents additional pieces of evidence to support this hypothesis.

Processes of cumulative causation and multiple self-reinforcing factors jointly result in increasing divergence in the productivity performance of firms. More specifically, while systematic differences in productivity between firms which do or do not invest in R&D and innovation clearly emerge, this is by no means the entire story. Indeed, when the innovation behaviour is isolated from other firm characteristics, differences in performance between the innovating and non-innovating firms are often due more to the differences in underlying firm characteristics than to whether or not the firms are being innovative.

The analysis of the dynamics of young firms in the region suggests that age may be an additional source of productivity difference. Generally, young firms are considered a potential engine of economic innovation, rejuvenation, and renewal. Kantis et al (2016) test this hypothesis by focusing on the characteristics and performance of new Latin American firms which have survived the start-up phase and have begun to face barriers related to consolidation and growth.[10] The authors indicate that young firms are an important segment of the economy — constituting almost 20% of LAC firms — and that they tend to be relatively dynamic: 40% of LAC young firms experienced sales growth rates higher than 10% between 2007 and 2009. All the same, though young firms tend to have more dynamic growth performance, they also appear to be less productive than more mature firms. In 2009, their average productivity was more than 20% lower than that of mature firms. Examining the main factors associated with the productivity performance of young firms, it is noteworthy that the introduction of innovations and the adoption of diversification strategies do not seem

10 In Kantis et al (2016), firms are considered young if they are between 4 and 10 years of age.

to affect productivity significantly. Again, the returns to innovation do not seem to be the same for all different kinds of firms.

Does it follow, generally, that in LAC, “old is beautiful”? Being in the market for many years may influence firms in many ways, such as being more innovative and benefitting more from it, using new technologies more intensively, and having a better trained workforce. We have no information and could not control for competition in markets and market-functioning, but one can safely assume that in some LAC markets, entry and exit do not occur smoothly and substantial rents and monopolistic niches remain. This hypothesis appears to be confirmed by the relation between financial markets and a firm’s access to finance and, consequently, performance (Presbitero and Rabellotti, 2016).

Lack of access to bank credit (not necessarily for innovation activities) often appears to constrain the growth, productivity, innovation, and export capacity of firms, especially in relation to small- and medium-sized enterprises (Ayyagari et al., 2012). Related economic literature indicates that the extent to which firms are financially constrained depends on micro factors, as well as institutional frameworks and credit market structures. On the one hand, for example, firms that are more informationally opaque (i.e., it is harder to acquire reliable information about them) are more likely to be financially constrained. On the other hand, factors such as degree of market concentration, proximity between lenders and borrowers, level of foreign bank penetration, institutional setting, and structure of credit market should affect access to credit.

Presbitero and Rabellotti (2016) empirically assess the determinants of the financing constraints firms and their link with productivity improvement by analysing the comprehensive WBES data for 31 LAC countries. These are combined with macroeconomic data on the credit market structure and institutional settings in different countries. Their evidence indicates that the use of bank credit is extremely limited for micro and young firms, while it is the second source of finance for large mature firms, accounting for 17.4% of the working capital of mature firms. The picture remains substantially the same for the demand for credit and the extent of credit availability: larger and older firms are more likely to demand bank credit and, consequently, are less likely to be financially constrained. Furthermore, labour productivity is found to be statistically associated with better access to credit. High-productivity firms are significantly more likely to demand credit and less likely to be financially constrained than low-productivity firms.

In an analysis specific to the Caribbean, Cathles and Pangerl (2016) show that, among firms that report lack of access to finance as the principal obstacle for their operations, only those that record very low or high productivity (i.e., the lowest decile or the upper half of the productivity distribution) are found to underperform compared to firms that

do not consider lack of access to finance as their main problem. In contrast, for firms located in other parts of the productivity distribution, there appear to be no major differences in performance between enterprises reporting and not reporting credit access as their main obstacle. These findings, together, suggest that there is a low productivity-financing constraints trap, where low-productivity firms cannot find the resources to invest in productivity enhancements in the financial markets. At the upper end of the distribution, the results for the more productive firms may be related to the difficulties in accessing finance for more sophisticated (and riskier) innovation-related activities, which are essential for improved performance.

Credit access is also affected by the characteristics of the banking sector. The degree of bank penetration (i.e., the number of branches per capita) is significantly correlated to whether or not borrowers are financially constrained and discouraged to seek financing. A limited presence of banks within an area can increase informational asymmetries between lenders and borrowers, limiting opportunities for firms to access credit markets. When the degree of competition is controlled for, a larger number of branches per capita reduces the average distance between firms and banks and this, in turn, reduces informational asymmetries and facilitates the screening and monitoring activities of banks. Interestingly, the openness to foreign banks can have both positive and negative effects on the financing constraints of firms, depending on the level of development of the financial markets. Foreign bank penetration has a negative effect on access to credit in less developed and more concentrated markets, while it has a positive influence in more competitive and financially developed markets.

Another important determinant of differences in enterprise performance is the linkages that firms themselves have with international markets. This relationship is complex and multifold. The standard result that low productivity firms remain in the domestic market while firms with higher productivity compete successfully in international markets is confirmed by many studies (Grazzi and Pietrobelli, 2016). Whilst firms that are partly (or fully) foreign-owned tend to be more productive, they do not invest more in R&D, they do not use ICT more intensively, and they are not more innovative. Multinational corporations do not carry out their R&D activities (nor their more knowledge-intensive activities) in the LAC region, which poses compelling questions concerning the approach that countries should follow towards foreign investors.

Montalbano, Nenci, and Pietrobelli (2016) confirm the well-established result of positive productivity premia associated with the participation in international trade and the presence of inward foreign direct investment, while controlling for the heterogeneity of firms by using dummies for country (year) and sector. They have tested this hypothesis for a large

sample of LAC countries, using firm-level (WBES) data. Furthermore, they add an important new element to the analysis of firms' participation in international markets: the nature of the integration of firms in GVCs (Montalbano, Nenci, and Pietrobelli, 2016). This has at least two important dimensions: the participation in GVCs, as such, and the positioning of firms along the value chain, whether more upstream (closer to primary resource processing and manufacturing) or downstream (closer to the market, in the assembly and commercial phases of the chain). In their empirical analysis, the authors focus on four large Latin American countries (Argentina, Brazil, Chile, and Mexico), and show that the actual level of involvement into GVCs matters for the productivity of these countries' firms. Moreover, they highlight the key role of the GVC position, with a positive impact of upstreamness on firm performance. This means that firms operating in the industries that export primary goods and intermediates that are used in other countries' exports tend to be, ceteris paribus, more productive than those firms that operate in industries whose value added comes primarily from processing imported inputs. Being upstream in a GVC has a positive impact on their productivity, and the firms involved in resource production and processing in the considered Latin American countries appear to be more productive than in the downstream assembly.

The Role of Policy

There is a growing interest in microeconomic explanations of economic performance and productivity in Latin America and the Caribbean, due to limitations of purely macroeconomic approaches and to the availability of new data sources that make these analyses possible (Busso et al., 2013; Grazzi and Pietrobelli, 2016). This emerging analytical trend is also reflected in an increasing variety of industrial and innovation policies that are trying to adopt a microeconomic focus, in the region (Crespi, Fernández-Arias, and Stein, 2014). However, this increasing variety is not mirrored by increasing volume. The size and scope of government programs aimed at directly supporting enterprise development across LAC remains limited. For example, Brazil — the Latin American country that devotes the largest amount of resources to enterprise development — is reported to use 0.085% of its GDP to support small- and medium-sized enterprises. In the United States, this figure is nearly five times as high (ECLAC, 2014). WBES data for LAC allows an assessment of the diffusion of such instruments and the actual levels of firm participation in such policy instruments.[11]

Overall, approximately 10.7% of all firms report having received any type of public support over the previous three years since 2010. Large differences, however, emerge when

11 In the 2010 round of WBES surveys in LAC, the IDB financed the inclusion of additional questions on participation in public support programs. These questions ask whether firms received public funding (either partial or full) for a range of business development services, from quality certification, to creation of business alliances, to innovation, to export promotion, and to training.

the responses are broken down by firm size. Only 6.6% of micro firms and 9.4% of small firms reported having received support, in comparison with 14.4% of medium-sized firms and 15.8% of large firms (Table 4). Most firms use only one publicly funded instrument and only a small fraction of firms participate in two or more programs (2.9%). Again, larger firms tend to participate more often in various programs simultaneously, and evidence has shown how important it is to participate in different programs to obtain their full benefits (Alvarez, Crespi, and Volpe, 2012). While many public programs in the region are often designed to support small- and medium-sized enterprises, the fact that large firms are using them disproportionally raises some doubt about the targeting capacity of the institutions in charge of such programs in the region.

Table 4. LAC Firms Participating in Publicly Supported Programs

	Participation in:			Participating in Innovation-related programs
	At least 1 program (%)	Only 1 program (%)	2 or more programs (%)	
All Firms	**10.7%**	**7.7%**	**2.9%**	**5.0%**
Micro Firms	6.6%	5.1%	1.4%	2.5%
Small Firms	9.4%	6.6%	2.8%	4.2%
Medium Firms	14.4%	10.4%	4.0%	6.8%
Large Firms	15.8%	11.7%	4.1%	9.4%

Source: Authors' elaboration on data from WBES 2010.
Notes: Includes both partially or entirely government-funded programs.

With regard to innovation, evidence reveals that only a limited number of firms in Latin America use innovation-related public policy programs and instruments[12] (Table 4). But when firms do have access to such programs, it has a positive influence on their decisions to invest in R&D. In contrast to Crespi and Zuñiga (2012), Crespi, Tacsir, and Vargas (2016) find strong evidence of the positive role played by public support for innovation in facilitating investment in new knowledge by Latin American manufacturing firms.

The data on firm access to publicly supported programs, however, does not provide us with information about the quality and design of these policies and programs. In other words, the question remains whether these programs address the right issues. Their design may or may not be consistent with a correct diagnosis of the factors hindering enterprise performance in LAC. We know that the quality of policy design is responsible for much of the successes and failures of many policies in the region (Crespi, Fernández-Arias, and Stein, 2014).

12 In the case of the Caribbean, this number is even lower since public support to innovation is still sporadic. According to WBES data, only 1.5 percent of Caribbean firms reported having participated in innovation-related programs in 2010. This low percentage is confirmed by the data in the Productivity, Technology, and Innovation in the Caribbean (PROTEQin) survey. In 2014, only 2.7 percent of firms received public support for innovation activities.

Depending on the objective of the intervention, policies to promote enterprise development can assume very different forms. For example, policies may address the two different sets of factors that affect a firm's performance— activities which, at least in principle, are within the control of the business and which are considered external factors or aspects of the operating environment (Syverson, 2011). Over the past 20 years in LAC, highest priority has been given to macroeconomic reforms that typically address the external factors that prevent an efficient allocation of resources across sectors and firms, by improving the business and investment environments and the functioning of markets.

These policies alone, however, only constitute a broad-brush effort to address the needs of firms. In fact, although a sound institutional and regulatory framework is a necessary condition for sustained firm growth, once these barriers are reduced, firms will respond to the same framework in different ways, depending on their characteristics and strategies. Once the basic framework is put in place, the achievement of efficiency improvements within firms will require detailed microeconomic policies that address the internal factors that hinder firm-level innovation, technological upgrading, improvements in management and organization, development of technical human capital, and entry into export markets.[13]

The inter-firm heterogeneity in productivity performance shown and analysed in this paper calls for specific policies for particular kinds of firms, each of which have their own binding constraints. For example, the lower returns to innovation investment at the bottom of the productivity distribution, shown in Section 3, suggest that the constraints to innovation for these firms are not primarily financial ones. These firms are, indeed, innovating; that is, they have the financial resources to innovate, but their innovations do not have much impact on their productivity. This has to do with some firm characteristics, such as the lack of complementary assets (e.g., capital, technical skills, infrastructure) or the lack of an adequate system to protect and promote innovation (e.g., rules governing the appropriability of the results from innovation, intellectual property rights regimes, among others). Public programs should therefore be tailored to distinct firm needs. Detailed research and impact evaluations should throw further light on what kind of specific tools should be employed in each case. The need for a balanced policy portfolio with different policies for different kinds of firms, however, derives from the remarkable heterogeneity that has been documented in this paper. For the numerous firms with low productivity levels, information asymmetries and

13 Some authors contend that there is a likely time sequence, where within-firm effects occur only after inter-firm reallocation has been made possible. In their study on Chile, Bergoeing and Repetto (2006) conclude that the reallocation effects took place earlier, and that within-plant productivity growth—driven by technology adoption and innovation—only contributed positively to aggregate productivity growth during the 1990s, subsequent to the consolidation of macroeconomic reforms. Some macroeconomic studies also appear to confirm this preliminary evidence, with productivity effects between sectors and between firms prevailing during the early years of policy reform in LAC during the 1970s and 1980s and within sectors and within firms prevailing later (Pagés, 2010).

externalities would call for technology extension services, technical training, easier access to common knowledge, and technology. On the other hand, a variety of tools are available for the few firms with higher productivity levels, such as the facilitation and promotion of university-industry collaboration, contract research with specialized technology centres, and advanced technical human capital formation. The choice will depend on the context and on rigorous analyses.

Moreover, macroeconomic reforms bring about—once and for all—static benefits. Once market flexibility is achieved (or restored), markets will function and failures will have been remedied, and the benefits from better resource reallocation will have materialized; these gains cannot be repeated. In contrast, the advantages from ongoing within-firm efficiency improvements can be continuously pursued through efforts and investments in innovation, human capital training, better organization and capabilities in firms, among others.

Conclusions

The low productivity of LAC economies has been acknowledged as a serious problem that calls for detailed analyses and appropriate and timely responses (Pagés, 2010; Crespi, Fernández-Arias, and Stein, 2014). In addition to macroeconomic and regulatory factors, productivity depends crucially on microeconomic aspects and on the specific strategies and decisions of individual firms. Such microeconomic decisions have been seldom studied in a quantitative and comparative manner. This paper addresses this gap in the literature.

The paper presents the results of recent original microeconomic evidence relating to LAC countries, showing that innovation significantly influences the productivity of firms, although to different degrees depending on the characteristics of the firms. Moreover, the impact of innovation on productivity also depends on additional complementary assets, such as access and use of ICT and on-the-job training, for which new evidence has been presented. Unprecedented studies of the Caribbean economies — also presented here — reveal that these conclusions substantially also hold true for these economies.

In the discussion other factors that can influence productivity have also been examined, such the age of firms, their access to credit and finance, and their participation in international markets and GVCs. A thorough understanding of these complex phenomena and their interrelations is an essential condition for the design of more effective public policies for the LAC region.

References

Alvarez, R., G. Crespi, and C. Volpe Martincus. 2012. *Impact Evaluation in a Multiple Program World*. Washington, DC: Inter-American Development Bank.

Anlló, G., G. Crespi, G. Lugones, D. Suárez, D., E. Tacsir, and F. Vargas, F. 2014. *Manual para la Implementación de Encuestas de Innovación*. Washington, DC: Inter-American Development Bank.

Ayyagari, M., A. Demirgüç-Kunt, and V. Maksimovic. 2012. "Financing of Firms in Developing Countries." World Bank Policy Research Working Paper, No. 6036, Washington, DC: The World Bank.

Bartelsman, E. J. and M. Doms. 2000. "Understanding Productivity: Lessons from Longitudinal Microdata." *Journal of Economic Literature* 38(3): 569–94.

Bartelsman, E., Haltiwanger, J., & Scarpetta, S. (2013). Cross-country differences in productivity: The role of allocation and selection. *The American Economic Review*, 103(1), 305-334

Benavente, J. M. 2006. "The Role of Research and Innovation in Promoting Productivity in Chile." *Economics of Innovation and New Technology* 154(5): 301–15.

Bergoeing, R. and A. Repetto. 2006. "Micro Efficiency and Aggregate Growth in Chile." *Cuadernos de Economía* 43(127).

Busso M., M. Madrigal, and C. Pagés. 2013. "Productivity and Resource Misallocation in Latin America." *B.E. Journal of Macroeconomics* 13(1): 903–932.

Cathles A. and S. Pangerl. 2016. "Caribbean Countries are Small but their Firms can Grow to be More Productive", in M.Grazzi and C.Pietrobelli.

Caves, R. E. 1998. "Industrial Organization and New Findings on the Turnover and Mobility of Firms." *Journal of Economic Literature* 36: 1947–1982.

Chudnovsky, D., A. Lopez, and G. Pupato. 2006. "Innovation and Productivity in Developing Countries: A Study of Argentine Manufacturing Firms' Behavior 1992–2001." *Research Policy* 35: 266–288.

Crepon, B., E. Duguet, and J. Mairesse. 1998. "Research, Innovation and Productivity: An Econometric Analysis at the Firm Level." *Economics of Innovation and New Technology* 7(2): 115–158.

Crespi, G. 2006. "Productivity and Firm Heterogeneity in Chile." PRUS Working Papers 36, Poverty Research Unit at Sussex: University of Sussex.

Crespi, G. and E. Tacsir, 2012. "Effects of innovation on employment in Latin America." Washington, DC: Inter-American Development Bank

Crespi, G. and P. Zuñiga. 2012. "Innovation and Productivity: Evidence from Six Latin American Countries." *World Development* 40(2): 273–90.

Crespi, G., E. Fernández-Arias, and E. Stein (eds). 2014. *Rethinking Productive Development: Sound Policies and Institutions for Economic Transformation*. Washington, DC: Inter-American Development Bank and New York: Palgrave Macmillan.

Crespi, G., E. Tacsir and F. Vargas. 2016. Innovation Dynamics and Productivity: Evidence for Latin America", in M.Grazzi and C.Pietrobelli.

Daude, C. and E. Fernández-Arias. 2010. On the Role of Productivity and Factor Accumulation in Economic Development in Latin America and the Caribbean. IDB Working Paper No. 41

Dollar, D., M. Hallward-Driemeier, and T. Mengistae. 2005. "Investment Climate and Firm Performance in Developing Economies." *Economic Development and Cultural Change* 54(1)

Dosi G. 1988. “Sources, Procedures, and Microeconomic Effects of Innovation.” *Journal of Economic Literature*, 26(3): 1120–71.

Easterly, W. and R. Levine. 2001. “It’s Not Factor Accumulation: Stylized Facts and Growth Models.” In *The World Bank Economic Review* 15(2): 177–219.

ECLAC (Economic Commission for Latin America and the Caribbean). 2014. “International Trade and Inclusive Development. Building Synergies”. Santiago: ECLAC.

Ericson, R. and A. Pakes. 1989. “An Alternative Model of Firm and Industry Dynamics.” Discussion Paper 445. New York: Columbia University.

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

Foster, L., J.C. Haltiwanger, and C.J. Krizan. 2001. “Aggregate Productivity Growth: Lessons from Microeconomic Evidence.” In Charles R. Hulten, Edwin R. Dean and Michael J. Harper (eds), *New Developments in Productivity Analysis.* 303–372. Chicago: University of Chicago Press.

González-Velosa C., D. Rosas and R. Flores. 2016. “On-the-Job Training in Latin America and the Caribbean: Recent Evidence”, in M.Grazzi and C.Pietrobelli.

Grazzi, M. and J. Jung. 2016. “ICT, Innovation, and Productivity: Evidence from Latin American Firms.“ in M.Grazzi and C.Pietrobelli.

Grazzi. M. and Pietrobelli C.. 2016. *Innovation and Productivity in Latin American and Caribbean Firms:* Palgrave, Forthcoming.

Griffith, R., S. Redding, and J. Van Reenen. 2004. “Mapping the Two Faces of R&D: Productivity Growth in a Panel of OECD Industries.” *The Review of Economics and Statistics* 864: 883-895.

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.

Hall, R. E., and C.I. Jones. 1999. “Why Do Some Countries Produce So Much More Output Per Worker Than Others?” *The Quarterly Journal of Economics*, 114(1): 83–116.

Hsieh, C., and P. Klenow. 2009 “Misallocation and Manufacturing TFP in China and India.” *The Quarterly Journal of Economics* 124(4): 1403–1448.

Jovanovic, B. 1982. "Selection and the Evolution of Industry." *Econometrica*, pp. 649-670.

Kantis H., J. Federico, P. Angelelli, S. Ibarra Garcia et al. 2016. “Business Performance in Young Latin American Firms”, in M.Grazzi and C. Pietrobelli.

Klenow, P. and A. Rodriguez-Clare. 1997. “The Neoclassical Revival in Growth Economics: Has It Gone Too Far?” In B. Bernanke and J. Rotemburg (eds), *NBER Macroeconomics Annual 1997*, 73–114. Cambridge, Mass: MIT Press.

Lall, S. 1992. “Technological Capabilities and Industrialization.” *World Development* 20: 165–86.

Lavopa, A. 2015. “Structural Transformation and Economic Development: Can Development Traps Be Avoided?” Doctoral Dissertation, Maastricht University.

Lundvall, B.Å. 1992. *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*. London: Pinter.

Mairesse, J. and P. Mohnen. 2010. “Using Innovation Surveys for Econometric Analysis.” NBER Working Paper 15857

McMillan M., D. Rodrik, and I. Verduzco-Gallo. 2014. “Globalization, Structural Change, and Productivity Growth, with an Update on Africa.” *World Development* 63: 11–32.

Mohan, P., E. Strobl, and P. Watson. 2016. "Innovative Activity in the Caribbean: Drivers, Benefits, and Obstacles." in M.Grazzi and C.Pietrobelli.

Montalbano, P., S. Nenci, and C. Pietrobelli. 2016. "International Linkages, Value Added Trade and LAC Firms' Productivity." in M.Grazzi and C.Pietrobelli.

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

Nelson R.R. 1991. “Why Do Firms Differ, and How Does It Matter?” *Strategic Journal of Management* 12(S2): 61–74.

Nelson R.R. and S.G. Winter. 1982. *An Evolutionary Theory of Economic Change.* Boston, Mass: Harvard University Press.

OECD (Organisation of Economic Co-operation and Development). 2001. “OECD Economic Outlook No. 69.” OECD 1(69). Paris: Organisation for Economic Co-operation and Development.

_____. 2009. “Innovation in Firms: A Microeconomic Perspective.” Paris: Organization for Economic Cooperation and Development (OECD)

_____. 2014. *Latin American Economic Outlook*. Paris: Organisation for Economic Co-operation and Development.

Pagés, C. 2010. *The Age of Productivity: Transforming Economies from the Bottom Up.* Washington: Inter-American Development Bank and New York: Palgrave Macmillan.

Perez, P., G. Dutrénit, and F. Barceinas. 2005. “Actividad Innovadora y Desempeño Económico: Un Análisis Econométrico del Caso Mexicano.” In I. Alvarez and C. Botella (eds.), *Innovación y Desarrollo: Retos para una Sociedad Global*. Fundación Carolina/Siglo XXI, Spain. 173–202.

Presbitero, A. and R. Rabellotti. 2016. "Is Access to Credit a Constraint for Latin American Enterprises? An Empirical Analysis with Firm-Level Data." in M.Grazzi and C.Pietrobelli.

Raffo, J., S. Lhuillery, and L. Miotti. 2007. “Northern and Southern Innovativity: A Comparison across European and Latin American Countries.” *The European Journal of Development Research* 20(2): 219–239.

Syverson C. 2011. “What Determines Productivity?” *Journal of Economic Literature* 49(2): 326–365.

Teece and Pisano. 1994. *“*The Dynamic Capabilities of Firms: An Introduction.” *Industrial and Corporate Change* 3(3): 537–56.

Williamson, O. E. 1973. “Markets and Hierarchies: Some Elementary Considerations.” *American Economic Review* 63(2): 316–325.

Williamson, O. E. 1985. *The Economic Institutions of Capitalism*. New York: Simon and Schuster.

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