

# FIRM INNOVATION AND PRODUCTIVITY IN LATIN AMERICA AND THE CARIBBEAN

THE ENGINE  
OF ECONOMIC  
DEVELOPMENT

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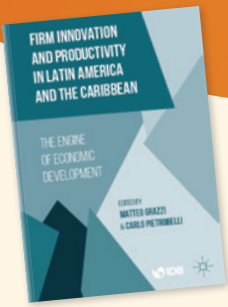
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# Firm Innovation and Productivity in Latin America and the Caribbean: *The Engine of Economic Development*

After a decade of favorable international conditions, most Latin American and Caribbean (LAC) countries are now confronting their reality. Despite the observed increases in growth rates, decline in unemployment, and spectacular figures in investment and saving, factors behind long-run growth and sustainability are still showing meager results. Total factor productivity has not changed in most LAC countries for more than a decade. This is alarming, since improvements on the inspirational side of economic growth are heavily correlated with movements in income per capita.

Most of the theoretical and empirical efforts have focused on analyzing the sources of this delay on a macro level. By examining aggregate figures related to research and development (R&D), foreign direct investments (FDI), macro regulations, and sometimes educational issues, it is possible to derive policy implications almost without considering several meso and micro characteristics of the countries that may determine the success or failure of these recommendations.

We have recently learned that heterogeneity matters. In most LAC countries, not only do different productive sectors show dissimilar productivity performances but this phenomenon is also observed inside the sectors. To disentangle those macro factors that are affecting the productive rhythm of the economies from those that are more sector or even firm specific, we need to use different lenses for the different observation units, because the mechanism behind those patterns may vary not only among countries but also among sectors and firms.

By taking thoughtfully the assumption that not only the level of productivity but also its variance matters, the book compiles several empirical works that, through different lenses, aim to reveal which variables may have a systematic effect on the productivity evolution observed at a firm and sectorial level in LAC countries. The book emphasizes knowledge generation, diffusion, and implementation mainly through innovation, while exploring the roles of human capital, financial resources, and linkages that also shape firm inspiration.

Results provided throughout the book show that there are several dimensions that matter, including the ways that policymakers design and implement public support to enhance productivity. Some results were expected but others were not. Some variables are relevant in certain countries, while others are relevant in certain productive sectors. The book is an invitation to a wider group of researchers and policymakers to have a closer look at what is happening at a sectoral or even firm level. Understanding the challenges that most of these firms, sectors, and countries are now facing and the way they surpass them is the key for the design of public policies.

This is part of the role of the Inter-American Development Bank, and especially of the Competitiveness and Innovation Division. By producing knowledge products in a collaborative and effective manner, promoting a growing research community, and supporting our policymakers in the areas of innovation, productivity, and human capital formation, we can help to increase economic performance and, in turn, improve the overall welfare of all citizens in the region.

**José Miguel Benavente**

Division Chief

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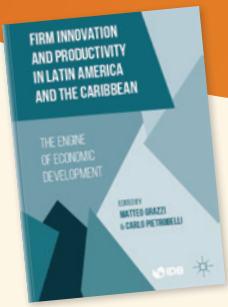
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# Firm Innovation and Productivity in Latin America and the Caribbean:

## *The Engine of Economic Development*

**A**fter 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 behavior 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 has grown steadily since 1960—to reach a level that is almost half of that of the United States.<sup>1</sup> Moreover, the LAC region remains one with little structural diversity and is increasingly dependent on natural resources. Today, commodities constitute approximately 60 percent of LAC's exports, compared with less than 40 percent 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 labor inputs) and growth of output per unit of input (total factor productivity, among

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<sup>1</sup> 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).

**The LAC region remains one with little structural diversity and slower growth. East Asian countries, instead, have grown steadily, reaching almost half of the income of the United States.**

others driven by technological progress). Estimates for LAC provide clear evidence that, despite years of rising factor accumulation, slow productivity growth<sup>2</sup> 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 percent per year, slightly below the rate of the United States (U.S.) 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 percent while it stagnated in LAC, more than compensating for the higher rate of factor accumulation there. Weak TFP performance can thus be taken to be the basis for LAC's inability to keep abreast with U.S. GDP per capita (Table 1).

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 percent to 69 percent of that of the United

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<sup>2</sup> Productivity is measured in multiple ways, with labor 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. Labor 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.



**TABLE 1:** Growth Accounting: Latin America and the Caribbean versus Comparison Countries, 1960–2011 (*in percent*)

Country/region	GDP per capita	Factor accumulation	TFP	% share
Average	(a)	(b)	(c)	(c) / (a)
Latin America and the Caribbean	1.79	1.80	-0.01	-0.06
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 based on data from Penn World Table 8.0.

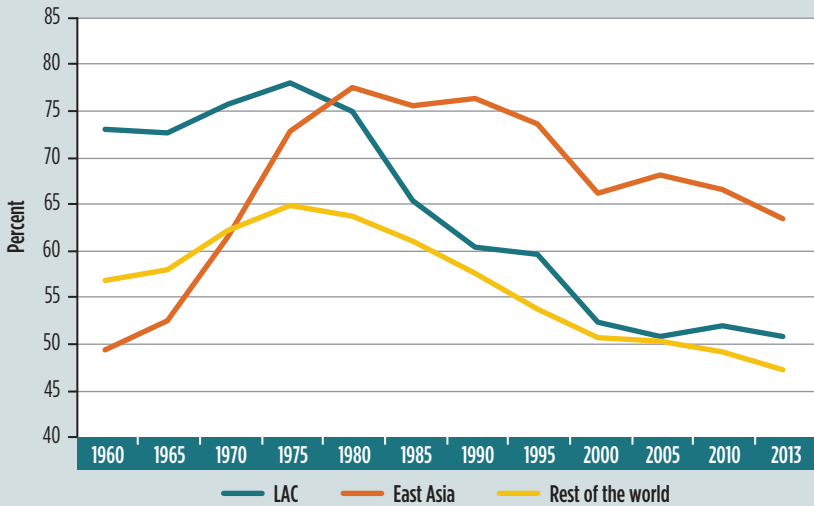
Notes: The countries in LAC include Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominica, the Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Honduras, Jamaica, Mexico, Panama, Paraguay, Peru, St. Kitts and Nevis, St. Lucia, St. 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.

States over the last 40 years, while in South Korea it grew from 20 percent to 63 percent during the same period. Overall, the East Asian economies have been successful in boosting total factor productivity, relative to that of the United States from 49 percent in 1960 to 78 percent in 1980. Following some decline, these economies stood at 64 percent 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 percent of U.S. TFP in 1960 to 51 percent in 2013.

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

**FIGURE 1:** Total Factor Productivity Relative to the United States, 1960–2013 (in percent)



Source: Authors' elaboration on data from Fernández-Arias (2014).

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 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 behavior 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, Hallward-Driemeier, and Mengistae, 2005; Bergoing and Repetto, 2006).

The first factor relates to the reallocation process between firms, which is only possible when resources can be easily allocated to different activities due to smoothly functioning markets (Busso, Madrigal, and Pagés, 2013). In this context, competitive pressures generate Schumpeterian processes of

**Macroeconomic data is useful to describe the aggregate phenomena; however, it can tell us little about the underlying microeconomic behavior that drives this dynamic.**

creative destruction, within sectors and across sectors. In the latter case, this process is expected to reshape economies toward more productive structures by shifting resources from less to more productive sectors. In recent years, this does not appear to have occurred in LAC. McMillan, Rodrik, and Verduzco-Gallo (2014) conclude that during the period 1990–2005, LAC experienced significant productivity gains within the same sectors, but displaced workers from the least productive firms and sectors 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 behavior 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).

It is important to examine both factors to explain the region’s poor productivity performance during recent years. While several authors have studied the first factor (i.e., reallocation of resources across firms and sectors) (Hsieh and Klenow, 2009; Busso, Madrigal, and Pagés, 2013), analysis of the second factor—productivity improvements within firms—is scant. This volume addresses this gap in the literature and explores how the different patterns of microeconomic behavior may have impacted productivity in the LAC region.

The book contains original papers that use data from the World Bank Enterprise Survey (WBES),<sup>3</sup> 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 behavior are sought. This text summarizes the main results of these papers.

The next section of this summary 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 behavior, 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) that 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

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<sup>3</sup> World Bank Enterprise Surveys (WBES) data are available for over 130,000 firms in 135 countries (<http://www.enterprisesurveys.org>, accessed on May 29, 2015). The WBES collects 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, labor, 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, including some related to innovation, business development services, and workforce training for human capital.

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 if 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 expected effects on productivity?

Two empirical studies included in the book—one focused on Latin America (Crespi, Tacsir and Vargas, Chapter 2) and the other on the Caribbean (Mohan, Strobl and Watson, Chapter 3)—build on the structural model that was first developed by Crepon, Duguet, and Mairesse (CDM)<sup>4</sup> to explore the relationships between innovation efforts, innovation outputs, and productivity in LAC.

First, both studies confirm that LAC firms are more likely to introduce product or process innovation if they invest more in innovation. More specifically, the innovation performance in LAC firms is strongly influenced by the amount of R&D. In Latin America, a 10 percent increase in R&D spending on average results in a 1.7 percent increase in the probability of a firm innovating, a 10 per cent increase in innovative sales results in a 1.3 percent increase in the probability of innovation. R&D spending 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 percent. This effect is higher than that found in previous studies for Latin American countries (with the exception of Chile) (Crespi and Zuñiga, 2012). Ultimately, spending on innovation has higher returns in terms of product innovation in the Caribbean than in most Latin American countries.

Second, innovation has a significant effect on productivity performance in the LAC region. The labor productivity of firms that are innovative is on

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<sup>4</sup> The CDM 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 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).

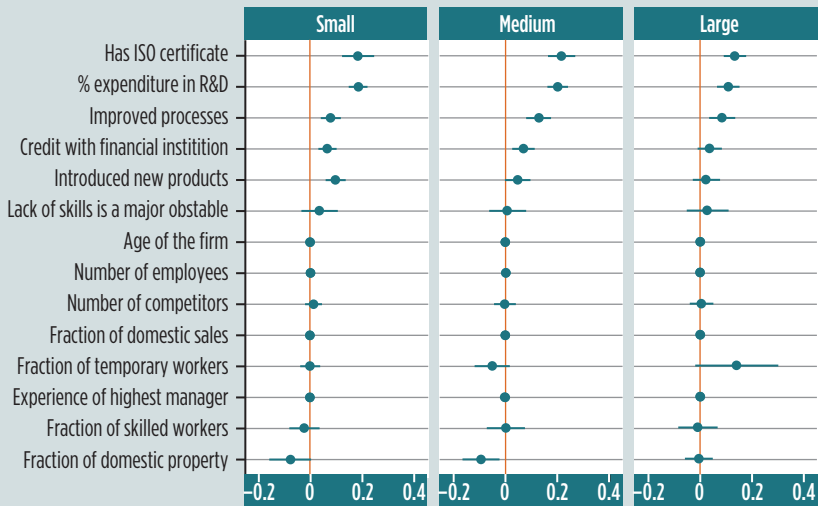
**LAC firms are more likely to introduce product or process innovation if they invest more in innovation. Also, innovation has a significant effect on productivity performance in the region.**

average, 50 percent 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 (Chapter 2) 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 labor productivity, human capital and on-the-job training are clearly of major importance. González-Velosa, Rosas, and Flores (Chapter 5) use 2006 and

**FIGURE 2:** Determinants of the Decision to Train in Latin America



Source: González-Velosa, Rosas, and Flores (Chapter 5).

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.

2010 WBES data for 11 countries to explore this relationship. They estimate 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 18 percentage points if a firm’s R&D expenses increase by 1 percent, and by 10 percentage 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.

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,

**Regardless of firm size, the decision of LAC firms to train their employees is associated with various measures of innovation and technological development.**

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. Grazi and Jung (Chapter 4) 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.

Their results 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 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 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



**The use of the Internet to perform research is positively and significantly related to innovation. Hence, ICT needs to be used appropriately to exploit its full potential.**

application of broadband for various activities has also been found to have an additional direct and positive effect on labor 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, as if firms were indeed 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 across firms, illustrating significantly differing realities.

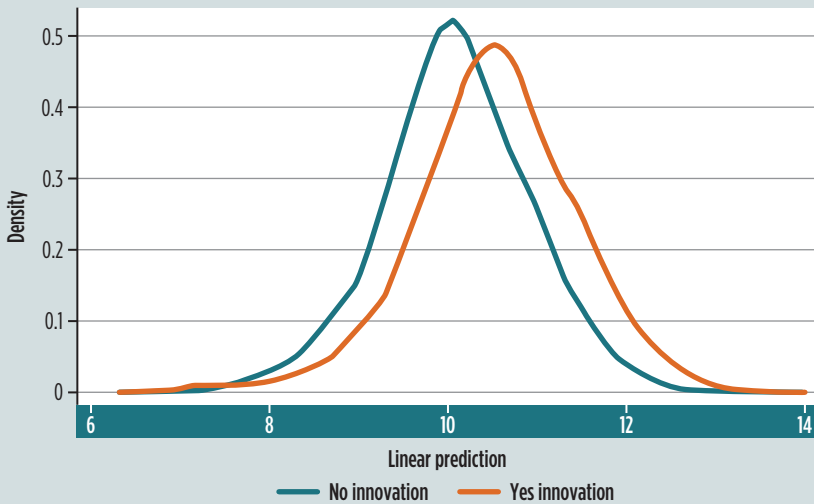
For example, Syverson (2011) discovered that of the industries within the same four-digit Standard Industrial Classification (SIC) code in the manufacturing sector in the United States, the plant in the 90th percentile of

**Innovation has much larger effects on the firms that are already more productive than others.**

the productivity distribution produces almost twice as much output with the same measured inputs as the plant in the 10th percentile. Even larger variation in productivity performance was recorded in China and India, with TFP in the 90th percentile on average five times as high as in the 10th percentile (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; 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 labor productivity in the 90th and 10th percentiles in manufacturing is approximately 10:1.

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 (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

**FIGURE 3:** The Heterogeneous Impacts of Innovation on Productivity in Latin American Firms



Source: Crespi, Tacsir, and Vargas (Chapter 2).

the disposal of the firm derive 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.

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 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 an average significant positive impact. 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 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 percent 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 percent versus 29–34 percent in the first three quartiles). The strongest effects of innovation are found among the most productive firms.

Interestingly, similar differences in coefficients between the bottom and the top of the distribution can also be observed with respect to human capital. Thus, while the premium for having a more educated workforce is 17 percent for firms at the bottom end of the distribution, it grows to almost 77 percent for firms at the top. This result is confirmed by the findings of González-Velosa, Rosas, and Flores (Chapter 5) 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 percent increase in the proportion of trained employees would raise productivity by 0.7 percent, 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. 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 increase the 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 behavior 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, Federico, Angelelli, and Ibarra Garcia (Chapter 6) 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. The authors indicate that young firms are an important segment of the economy—constituting almost 20 percent of LAC firms—and that they tend to be relatively dynamic: 40 percent of LAC young firms experienced sales growth rates higher than 10 percent 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 percent lower than that of mature firms. Examining the main factors associated with the productivity performance of young firms,

**40 percent of LAC young firms  
experienced sales growth  
rates higher than 10 percent  
between 2007 and 2009.**

it is noteworthy that the introduction of innovations and the adoption of diversification strategies do not seem to affect productivity significantly. Again, the returns to innovation do not seem to be the same for all different kinds of firms.

Therefore, 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, Chapter 8).

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, Demirgüç-Kunt y Maksimovic, 2012). Presbitero and Rabellotti empirically assess the determinants of the firms’ financing constraints and their link with productivity improvement by analyzing 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 percent 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, labor 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 (Chapter 7) 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

**Bank credit is extremely limited for micro and young firms, while it is the second source of finance for large mature firms. High-productivity firms are more likely to demand credit and less likely to be financially constrained.**

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 is significantly correlated to whether or not borrowers are financially constrained and discouraged to seek financing. On the other hand, 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. 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 (Chapter 10) 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 test 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 Global Value Chains (GVCs). 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 those in the downstream assembly.



**In Argentina, Brazil, Chile,  
and Mexico the actual level  
of involvement into GVCs  
matters for productivity.  
Being upstream in the value  
chain improves productivity.**

## The Role of Policy

The growing interest in microeconomic explanations of economic performance and productivity in Latin America and the Caribbean is 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 percent 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.<sup>5</sup>

Overall, approximately 10.7 percent of all firms report having received any type of public support over the previous three years since 2010. Large differences, however, emerge when the responses are broken down by firm size. Only 6.6 percent of micro firms and 9.4 percent of small firms reported having received support, in comparison with 14.4 percent of medium-sized

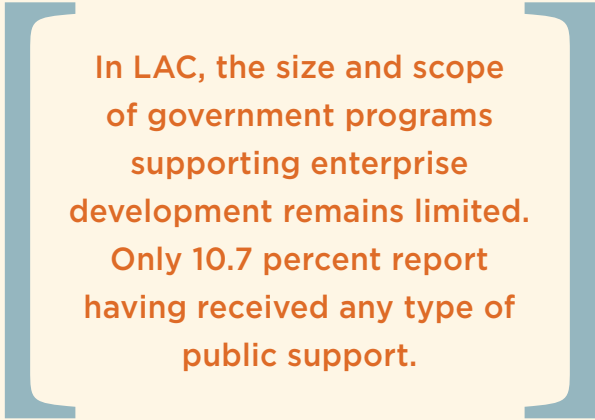
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<sup>5</sup> In the 2010 round of WBES surveys in LAC, the IDB financed the inclusion of additional questions on participation in public support programs. These questions ask whether firms received public funding (either partial or full) for a range of business development services, from quality certification, to creation of business alliances, to innovation, to export promotion, and to training.

firms and 15.8 percent of large firms (Table 2). Most firms use only one publicly funded instrument and only a small fraction of firms participate in two or more programs (2.9 percent). 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 disproportionately raises some doubt about the targeting capacity of the institutions in charge of such programs in the region.

With regard to innovation, evidence reveals that only a limited number of firms in Latin America use innovation-related public policy programs and instruments<sup>6</sup> (Table 2). But when firms do have access to such programs, it has a positive influence on their decisions to invest in R&D (Crespi, Tacsir, and Vargas, Chapter 2).

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 effectively address the right issues. Their design may or may not be consistent



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<sup>6</sup> 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.

**TABLE 2:** LAC Firms Participating in Publicly Supported Programs (in percent)

	Participation in:			Participation in innovation-related programs
	At least 1 program	Only 1 program	2 or more programs	
<b>All firms</b>	<b>10.7</b>	<b>7.7</b>	<b>2.9</b>	<b>5.0</b>
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.

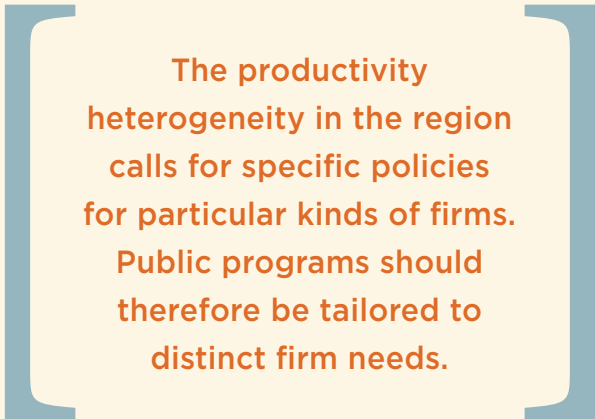
Notes: Includes both partially or entirely government-funded programs.

with 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).

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 activities 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 preventing 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 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.

The inter-firm heterogeneity in productivity performance shown and analyzed in this book 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



**The productivity heterogeneity in the region calls for specific policies for particular kinds of firms. Public programs should therefore be tailored to distinct firm needs.**

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 here. For the numerous firms with low productivity levels, information asymmetries and 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

centers, 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. In addition to macroeconomic and regulatory factors, productivity depends crucially on microeconomic aspects and on the specific strategies and decisions of individual firms.

This book 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.

The book also discusses factors that can influence productivity, such the age of firms, their access to credit and finance, and their participation in international markets and GVCs. The thorough analyses aim to deepen the understanding of these complex phenomena and their interrelations, which is essential 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.
- Ayyagari, M., A. Demirguc-Kunt, and V. Maksimovic. 2011. "Small vs. Young Firms across the World: Contribution to Employment, Job Creation, and Growth." Policy Research Working Paper 5631. Washington, DC: The World Bank.
- Bergoeing, R. and A. Repetto. 2006. "Micro Efficiency and Aggregate Growth in Chile." *Cuadernos de Economía* 43(127): 169-91.
- Busso, M., L. Madrigal, and C. Pagés. 2013. "Productivity and Resource Misallocation in Latin America." *The BE Journal of Macroeconomics* 13(1): 903-32.
- Crépon, 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): 115-58.
- Crespi, G., E. Fernández-Arias, and E. Stein (eds.). 2014. *Rethinking Productive Development: Sound Policies and Institutions for Economic Transformation*. Development in the America Series. Washington, DC: Palgrave Macmillan and 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.
- Daude, C. and E. Fernández-Arias. 2010. "The Importance of Ideas: Innovation and Productivity in Latin America." In C. Pagés (ed.), *The Age of Productivity: Transforming Economies From the Bottom Up*. Washington, DC: Palgrave Macmillan and Inter-American Development Bank.
- Dollar, D., M. Hallward-Driemeier, and T. Mengistae. 2005. "Investment Climate and Firm Performance in Developing Economies." *Economic Development and Cultural Change* 54(1): 1-31.
- Dosi, G. 1988. "Sources, Procedures, and Microeconomic Effects of Innovation." *Journal of Economic Literature* 26(3): 1120-71.

- Easterly, W. and R. Levine. 2001. "What Have We Learned from a Decade of Empirical Research on Growth? It's Not Factor Accumulation: Stylized Facts and Growth Models." *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.
- Fernández-Arias, E. 2014. *Productivity and Factor Accumulation in Latin America and the Caribbean: A Database*. Washington, DC: Inter-American Development Bank.
- Foster, L., J. Haltiwanger, and C. J. Krizan. 2001. "Aggregate Productivity Growth: Lessons from Microeconomic Evidence." In C. R. Hulten, E. R. Dean, and M. J. Harper (eds.), *New Developments in Productivity Analysis*. Chicago, IL: University of Chicago Press.
- Griffith, R., E. Huergo, J. Mairesse, and B. Peters. 2006. "Innovation and Productivity across Four European Countries." *Oxford Review of Economic Policy* 22(4): 483-98.
- Hall, R. E. and C. I. Jones. 1999. "Why do Some Countries Produce so much more Output per Worker than Others?" Working Paper 6564. Cambridge, MA: The National Bureau of Economic Research.
- Hsieh, C. T. and P. J. Klenow. 2009. "Misallocation and Manufacturing TFP in China and India." *Quarterly Journal of Economics* 124(4): 1403-48.
- Klenow, P. and A. Rodriguez-Clare. 1997. The Neoclassical Revival in Growth Economics: Has it Gone too Far?" In NBER *Macroeconomics Annual 1997*, Volume 12. Cambridge, MA: 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 Thesis. The Netherlands: 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 No. 15857. Cambridge, MA: National Bureau of Economic Research.

- McMillan, M., Rodrik, D., and I. Verduzco-Gallo. 2014. "Globalization, Structural Change, and Productivity Growth, with an Update on Africa." *World Development* 63: 11-32.
- 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 Management Journal* 12(S2): 61-74.
- Nelson, R. R. and S. G. Winter. 1982. *An Evolutionary Theory of Economic Change*. Cambridge, MA: Harvard University Press.
- OECD (Organisation for Economic Co-operation and Development). 2009. *Innovation in Firms: A Microeconomic Perspective*. Paris: OECD.
- \_\_\_\_\_. 2014. *Perspectivas económicas de América Latina 2014: logística y competitividad para el desarrollo*. Paris: OECD.
- Pagés, C. (ed.). 2010. *The Age of Productivity: Transforming Economies From the Bottom Up*. Development in the Americas Series. Washington, DC: Palgrave Macmillan and Inter-American Development Bank.
- Syverson, C. 2011. "What Determines Productivity?" *Journal of Economic Literature* 49(2): 326-65.
- Teece, D. and G. Pisano. 1994. "The Dynamic Capabilities of Firms: An Introduction. Industrial and Corporate Change." *Oxford Journal* 3(3): 537-56.
- Williamson, O. E. 1973. "Markets and Hierarchies: Some Elementary Considerations." *American Economic Review* 63(2): 316-25.
- \_\_\_\_\_. 1985. *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*. New York: Free Press.







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