Title: Review of firm productivity in Colombia

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Main findings

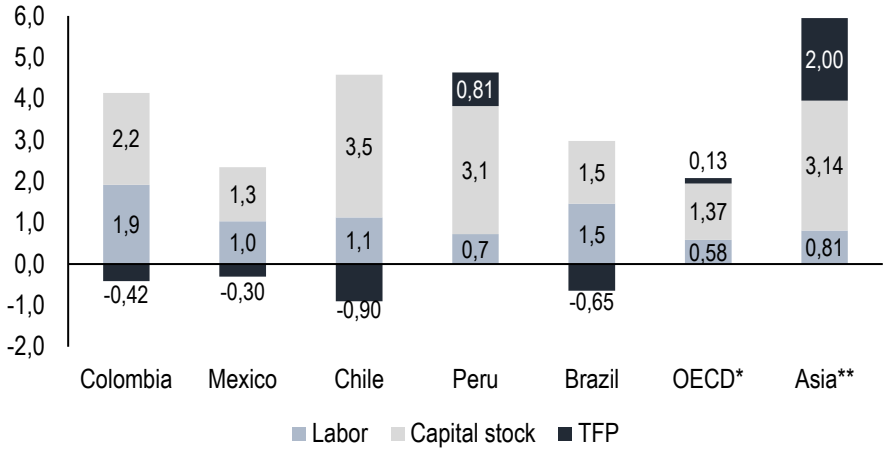
- Colombian low levels of productivity are explained mostly by factors affecting firms' decisions and performance. These factors are both internal to the firms, like poor technology adoption, low levels of innovation, R&D and STI expenditure, as well as external, such as a high regulatory burden that induces business informality and low levels of competition, among others.
- Colombia has implemented several pilots and programs of technological extension. However, they remain small and their management and implementation need to improve.
- The country lags the OCDE and Latin American country average with respect to R&D and STI activities intensity[1]. Firms have a low interest in adopting technology, which may be related to weak managerial capabilities, leading to low investment in ICT and 4.0 technologies.
- The Colombian political economy has led to a coexistence of economy-wide pro-productivity reforms with targeted policies that inhibit resource reallocation, technology transfer and adoption, and innovation.
- There is a need to reduce regulatory costs in order to increase formality; strengthen competition policy and improve the adequacy of human capital to the needs of the productive sector.

Diagnostic

Colombian productivity remained stagnant over the last two decades. Based on estimations from The Conference Board, between 2000 and 2019 the average annual growth of total factor productivity (TFP) was negative (-0.42 %). Moreover, labor productivity in Colombia has remained unchanged in recent years and the gap vis-à-vis other countries is widening. In 2017, a US worker produced four times more than a Colombian worker (The Conference Board, 2018).

[1] STI activities intensity or R&D intensity = STI activities expenditure or R&D expenditure as percentage of GDP

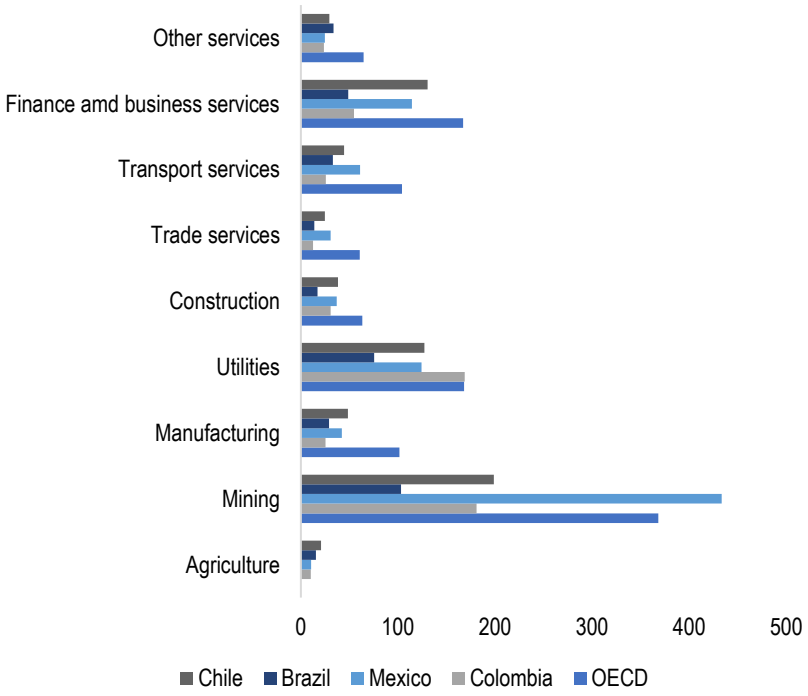
Figure 1. Economic growth factors, 2000 – 2019.



Source: The Conference Board. *Average as GDP-weighted, without Colombia. **Average as GDP-weighted.

Colombian labour productivity is concentrated in few sectors. The most productive sectors in Colombia, measured by labour productivity, are mining and utilities. In general, labor productivity in Colombia is fewer than the OECD average, Chile and Mexico in all sectors, except in utilities. Despite the importance of agricultural and construction sectors in Colombia, they show low labor productivity compared with other countries.

Figure 2. Labour productivity 2017 (2011 international PPP exchange rate, thousands).

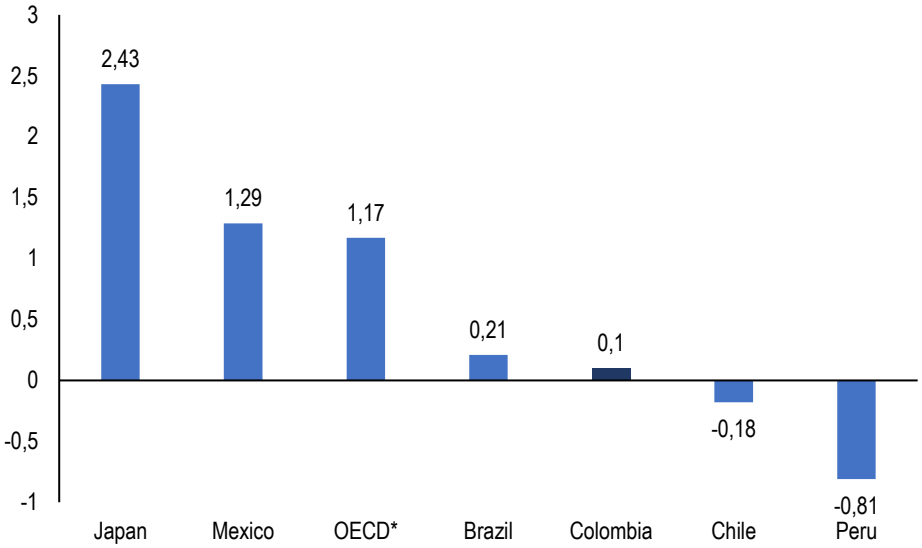


Source: DNP with data from "Global Productivity Trends" database. OECD weighted average according GDP from Conference board and sectorial added value without Israel.

Low levels of diversification and marked regional differences of the productive sector. The productive structure of the country is heavily concentrated on the service sector (67 % of the GDP), followed by manufacturing industries (12 %), agriculture (7 %) construction, (7 %), and mining (6 %) (DANE, 2020). In

addition, compared to other economies, Colombia is ranked 56 out of 133 in the Economic Complexity Index (ECI) because its lack of exports diversification (Harvard's Growth Lab, 2020). Within the country, there is a heterogeneous productive development. Six (Cundinamarca, Bogotá, Bolívar, Caldas, Valle del Cauca and Antioquia) out of 32 departments plus the country capital have the highest ECI in 2017 and concentrated around 60 % of Colombia's GDP in 2018 (Datlas, 2020).

Figure 3. Economic Complexity Index, 2018.



Source: Atlas of Economic Complexity. *Average OECD countries without Colombia, Iceland and Luxembourg.

These low levels of productivity are explained mostly by factors affecting firms' decisions and performance. From a firm's perspective, low levels of productivity among Colombian productive units are associated with low levels of technology transfer and adoption, innovation, poor quality of management, as well as a disregard for product quality considerations in the productive process. However, productivity is also affected by external factors, like the political economy which often leads to policies targeted to certain sectors, high levels of informal labor and informal productive units, a mismatch of human capital demands and supply and low levels of market competition (Departamento Nacional de Planeación, 2016).

a) Internal factors

i. Knowledge and Technology Adoption or Transfer

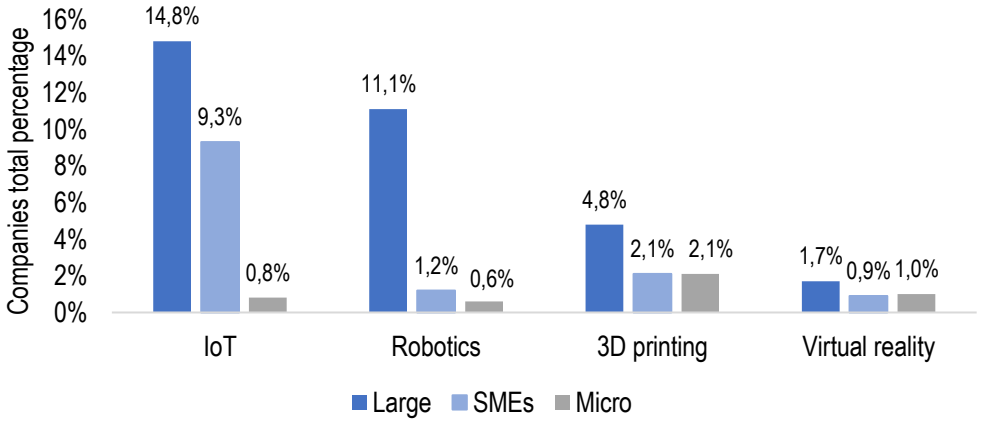
Colombia displays a lag in high-tech business infrastructure and Colombian firms show little interest to improve their production processes with new technology. According to the Global Innovation Index (Cornell University, INSEAD, & WIPO, 2019), only 1.3% of Colombia's exports are high-tech, while the percentage of exports of ICT services is only 0.7%, placing 64th and 92nd out of 142 countries, respectively. Also, only 0.2% of manufacturing in Colombia yields high or medium-high technology products. Finally, Colombia ranks 86th on the percentage of knowledge-intensive jobs, with only 46.7% of the economically active population. According to the Colombian Manufacturing Survey, 67% of manufacturing companies demand external assistance to adopt production techniques and technologies (DANE, 2019). On the other hand, disparities have been identified by business size and age, since 42% of smaller companies and 47% of young companies do not seek any type of support for knowledge and technology transfer.

The percentage of Colombian companies with access to internet is high, but challenges remain regarding internet speed. According to data from DANE (2018), 99.6% of companies in commerce and

manufacturing sectors have internet access and use computers in the workplace, and 52.8% of workers in Colombia used the internet to carry out their daily activities. However, according to OECD data (2019), of 28 countries surveyed, Colombia has the highest percentage of companies with a download speed of less than 10 Mpbs (45.72%). Moreover, Colombia has a low percentage of companies with download speeds greater than 100 Mpbs, occupying the third to last place on the list. Compared to countries in the region, Colombia has an average internet connection speed of 5.5 Mpbs, ranking below regional peers like Uruguay (9.5 Mpbs), Chile (9.3 Mpbs), Mexico (7.5 Mpbs) and Peru (6.2 Mpbs)(Akamai, 2017)

Innovative companies in Colombia dedicate few resources to the acquisition of ICT technologies, which is consistent with the level of adoption of industry 4.0 technologies. According to data form DANE **Fuente especificada no válida.** (2019), between 2015 and 2018 Colombian companies only allocated an average of 6.25% of the resources invested in STI in adoption of ICT technologies. This is consistent with the Technical Bulletin on Basic Indicators of Ownership and Use of Information and Communication Technologies for Companies (DANE, 2018), where the use of Internet is concentrated in low-technology activities such as sending emails (99.9%) and searching for information (97.8%). Moreover, according to the Observatory of Digital Economy (2017), , although there are technologies related to Industry 4.0 that have a higher level of adoption such as cloud computing and cybersecurity, other technologies such as Artificial Intelligence, Internet of Things, Robotics, 3D printing and Blockchain still have a low level of penetration in the Colombian industry. (Figure 4)

Figure 4. Advanced technology adoption by firm size.



Source: Digital observatory (MINTIC, 2017).

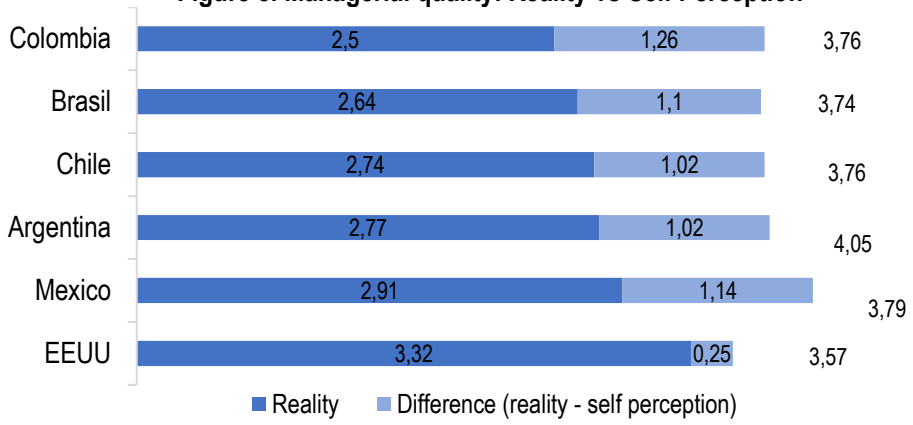
There is weak organization of technical and business assistance services for the transfer of knowledge and technology. One of the obstacles identified for innovation and improvements in productivity is the low information on available technology, as perceived by 45 % of innovative and potentially innovative companies and 53 % of non-innovative companies (Departamento Nacional de Planeación, 2016). In Colombia, there is a low level of market development to connect those who know about business assistance services and business that demand those services. This reflects coordination failures for the development of the business development services market (Departamento Nacional de Planeación, 2016). In addition, a survey showed nearly 80 % of respondents stated that there was a low supply of skilled workers and that SENA and other technical programs and technical schools failed to improve labor skills for experienced workers (Melendez & Perry, 2010).

Low capacities and investment to adopt and transfer knowledge and technology. Only 7 % of the amount invested by companies is made to adopt or transfer technology or knowledge. The private sector presents a low quality of business management based on international parameters, which limits the knowledge absorption (Departamento Nacional de Planeación, 2016). The levels of management practices of an average Colombian manufacturing firm are low in comparison to global standards and similar to that in countries like India and Kenya, which have lower per-capita incomes (Iacovone, Maloney, & McKenzie, 2018). In addition, there is a lack of

technological extension providers suited for the needs of Colombian firms. The activity that external consultants ('extension agents' or '*extensionistas*' in Spanish) carry out to support SMEs is resource, technological, and knowledge-intensive. More training programs for extension agents are needed to meet demand (Centro Nacional de Productividad, 2018).

Colombian companies not only display low managerial capabilities in identifying improvements and generating innovations, but also Colombian managers perceive themselves as being much better than what objective evaluations suggest. These are grouped into four dimensions, i) allocation of resources to identify process improvements and innovation, (for example, the use just in time processes), ii) internal feedback mechanisms, which are summed up by monitoring, evaluation and follow-up systems of company processes, results and conditions, iii) long-term planning, (definition of goals and objectives), and iv) the human capital necessary to support the above dimensions (Cirera & Maloney, 2017). Additionally, according to the World Management Survey (WMS) management practices in Colombia are deficient (average score[2] of 2.57), compared to peer countries. The gap between this objective score and Colombian companies' self-evaluation score (3,76) is one of the largest in the world (Figure 5). This may lead to difficulty in accepting or identifying problems, compromising companies' response to changes in market conditions, identifying new technological opportunities, developing plans to exploit these opportunities and cultivate the human resources necessary to innovate (Cirera & Maloney, 2017; Rogers, 2013).

Figure 5. Managerial quality: Reality vs Self Perception



Source: World Management Survey (2014).

Large companies (200 employees or more) tend to have the best managerial practices. For instance, 71.4% of large companies act against a problem that arises in production processes, carry out actions to ensure that it does not happen again, and initiate a process of continuous improvement to anticipate such problems. In contrast, only 36% of companies with less than 50 employees take actions to solve the problem. Additionally, 55.2% of companies with more than 200 employees have 10 or more performance indicators and 84% offer promotions to employed personnel other than managers (DANE, 2019).

Pilot programs of technological extension implemented in Colombia have showed positive effects on management practices. One of the pilots was implemented in the automobile parts sector in 2012. The pilot's impact evaluation showed that both individual and group-consulting lead to improvements in management practices of a similar magnitude (8 to 10 percentage points), in which the group-based approach dominates on a cost-benefit basis. Moreover, to reduce the costs of implementation, providing extension support on a group basis should be considered (Iacovone, Maloney, & McKenzie, 2018). Another pilot in technological extension, was "Colombia Productiva", providing technological extension for small and medium-sized enterprises (SMEs)

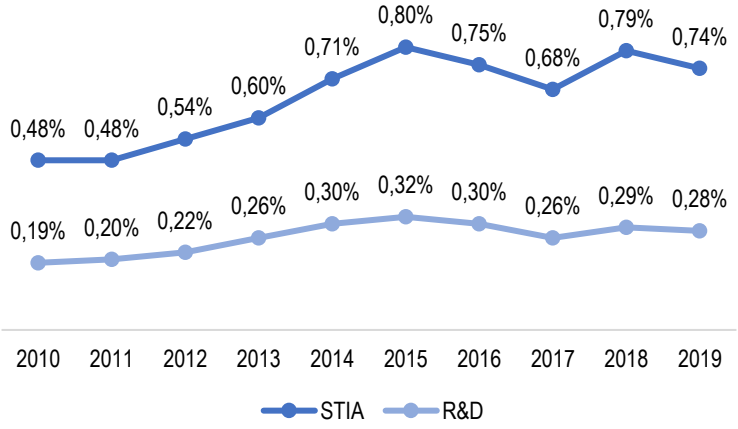
[2] The Survey uses an interview-based evaluation tool that defines 18 basic management practices and scores them from **one** (\worst practice") to **five** (\best practice") on a scoring grid.

willing to improve their products to bring them to the international market. The program implemented in 2018 served around 200 SMEs in five different areas. Currently, the program is under an impact evaluation led by the World Bank Group.

ii. R&D and STI activities expenditure

Colombia lags behind in R&D and STI spending with respect to the OCDE and Latin American. During the last decade, investment in R&D and STI only increased from 0.19% and 0.48% to 0.28% and 0.74% respectively (Figure 6). However, this growth halted around 2015 and have fluctuated around 0.29% and 0.75%, respectively. This level of R&D investment is below the Latin American average (0.35%) and is only a fraction of the OECD average (2.36%) (OECD, 2020; RICYT, 2020; OCyT, 2020).

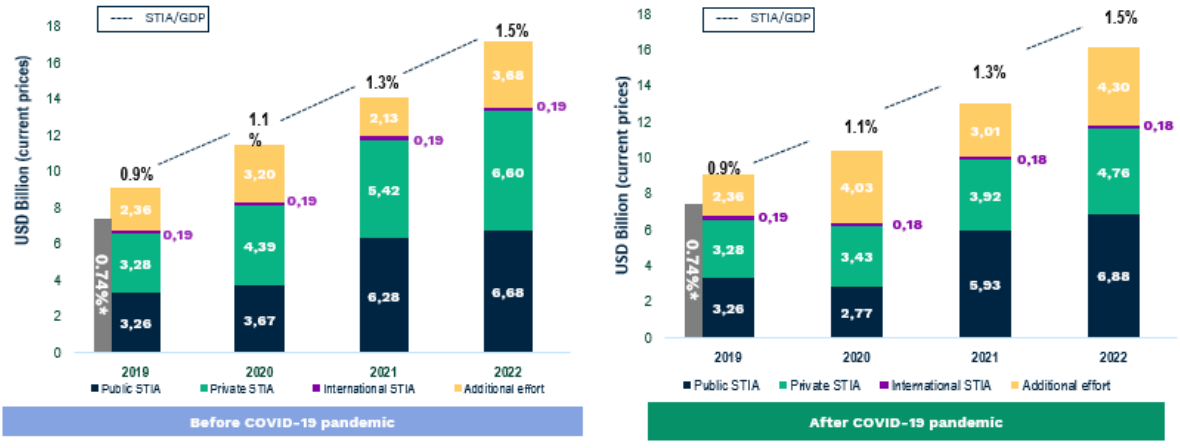
Figure 6. STIA and R&D intensity.



Source: OCyT *(2020)*.

The Colombian government is well behind its STI investment goals. To meet the national STI investment goals for 2022 the central government must invest an additional USD 2.87 billion[3] (0.8% of GDP) with respect to what is currently being planned. This gap is USD 0.47 billion higher compared to what it was projected before the COVID-19 pandemic hit. (Figure 7).

Figure 7. STIA intensity projections[4]



[3] Current rate exchange at 06/25/2020.
[4] *2019 Preliminar estimation. STIA = Science, Technology, and Innovation Activities

Source: DNP based on OCyT (2020) and World Bank (2020) data.

STI policy instruments have low diversification and efficiency. The World Bank (2015, pág. 13) found that 77% of the STI policy instruments were subsidies, while mechanisms such as innovation vouchers or public procurement of innovation were absent. In addition, DNP & The Presidency (2019) found that 50% of policy instruments for competitiveness and innovation are allocated to the provision of sectoral market interventions (subsidies), despite recommendations to privilege the provision of public goods (DNP, 2016). . On the other hand, the preliminary offer of STI instruments for 2020 exhibits: i) *high concentration*, since only 7.8% of instruments concentrate 80.1% of the total assigned resources, ii) *significant atomization*, given that 52.5% of instruments have resources equal to or less than USD 250.000 and iii) *low user segmentation*, since more than 60% of the instruments are oriented simultaneously towards 3 or more types of users (DNP, 2020).

Financial markets for STI development are unbalanced or in a nascent state. In 2019, the country had an insufficient supply of financial resources at some levels of the STI project maturity. While the 'research and feasibility' and 'scaling up and maturity' stages had budgets of around USD 3 billion (0.91% of GDP) and 2.7 billion (0,81% of GDP) respectively, the development and growth stages had only a budget of USD 0.4 billion (0.12% of GDP) (Unión Temporal VOZ, 2020). On the other hand, the development of the credit market to finance innovation activities has had an isolated and low-scale history (Minciencias, 2018). Indeed, less than 23% of innovative companies use this type of financing to leverage STI investments[5].

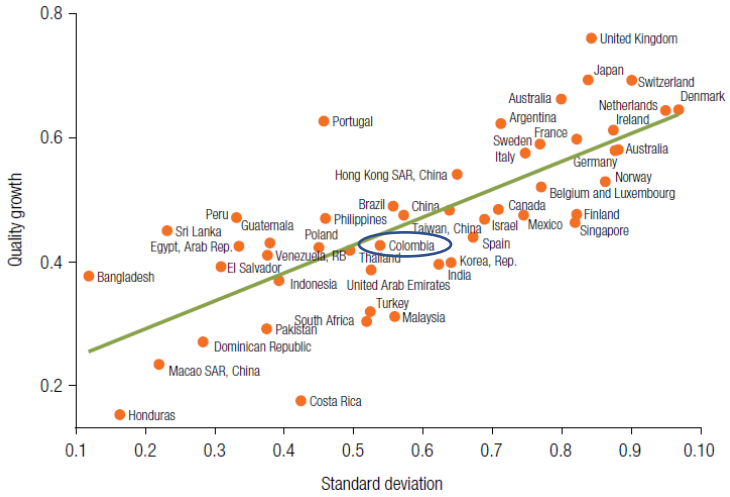
The forecasted economic slowdown due to the COVID-19 pandemic will negatively impact STI activities in Colombia due to its procyclical nature. Previous studies have shown that private R&D intensity is procyclical while public investment is contracyclical in leading innovation countries and procyclical in the rest (European Commission, 2011; Ouyang, 2011; Pellens et al, 2018).. Additionally, 1 of each 4 firms cut off its innovation budget in Latin America (Paunov, 2012).. For the Colombian case, both public and private investment in R&D exhibited a procyclical behaviour.

iii. Quality in the Productive Process and Quality Infrastructure

Dynamics of product quality changes show the tradeoff between risk and return in quality improvements in the exporting countries. Krishna, et.al (2020) find empirical evidence that there is a strong positive relationship between the mean and the variance of quality growth[6], consistent with a risk-return tradeoff. This relationship is positive across the sectoral dimension, for instance, industrial machinery and electronic products have both higher mean and higher variance than food products and textiles. These findings also suggest a mean-variance tradeoff in product quality improvements along the countries' development path because of the tradeoff between risk and return. Countries with high mean and variance combinations, like United Kingdom, Japan, and Germany, produce a basket containing on average products of higher risk-return sectors, while developing countries occupy the less risky parts of the frontier. Colombia is located in the middle of the frontier with products with medium level of mean-variance of quality growth.

[5] Estimations made by DNP from the national Technological Development and Innovation Survey (EDIT).
[6] The authors use product unit values (trade value divided by trade quantity) as a proxy for product quality of exported products to the US from 1989 and 2001.

Figure 8. Rate of quality growth and variance of quality growth



Source: Krishna, Levchenko, and Maloney 2018, cited by Cusolito & Maloney (2018).

Poor availability of services for the improvement of quality of products. In developing countries like Colombia, local companies tend to demand services providers abroad to support and improve the quality of their products and processes to meet the needs of their international clients, due to the unavailability or unacceptable results of some of these services at the national level (calibration laboratories, auditors and certifiers). This increases costs, decreases competitiveness, and prevents entry in new markets (ONUDI, 2020). Furthermore, most laboratories and quality services providers are concentrated in main industrial cities hindering industrial development in other regions (OECD/UN/UNIDO, 2019).

Lack of trust in the national quality infrastructure[7]. In Colombia, private leading firms have few links to, and low trust in, the domestic public quality infrastructure (OECD/UN/UNIDO, 2019). One aspect that contributes to this mistrust is the low participation of laboratories in research, development and innovation projects, which has created a poor image of this segment of quality services in the country (Gallego & Gutiérrez, 2016).

The human capital available for quality services is not well qualified. In Colombia there is a lack of qualifications of the personnel that carry out the activities in testing laboratories (Gallego & Gutiérrez, 2016). The formation of human capital of Colombian laboratories exhibited two type of gaps. From a theoretical point of view, it lacks formation in basic metrology, magnitudes, measurements, estimation of uncertainty, instruments, and measurement methods. From a practical point of view, the gaps are related to the unfamiliarity of the importance of metrology in the industry, and a lack of access to measuring equipment or instruments (Ministerio del Trabajo & OEI, 2020). Furthermore, improving the technical capacity of human capital that defines and stablishes technical regulations at the government agencies is key (Fedesarrollo, 2013).

The National Government established a national policy intended to strengthen the national quality infrastructure with a focus on laboratories (CONPES document 3957 of 2019)[8]**.** The policy includes strategies for strengthening national measurement capabilities as a tool for enhancing national competitiveness and productivity. The objectives of this policy are, on one hand, improving and expanding the supply of testing and calibration services to favor participation of Colombian products in global value chains. On the other hand, this policy seeks to establish appropriate incentives to guarantee the demand and supply of laboratory services for strengthening the competitiveness and promote consumer and environmental protection (Departamento Nacional de Planeación, 2019)**.**

[7] The term "quality infrastructure" refers to the set of organizations (public and private), policies, regulatory framework and practices necessary to support and improve the quality and safety of goods, services and processes (ONUDI, 2020).

[8] National Laboratories Policy: Priorities to improve compliance of quality standards (CONPES document 3957 of 2019)

b) External factors

i. Political Economy of the Colombian Policy Making Process

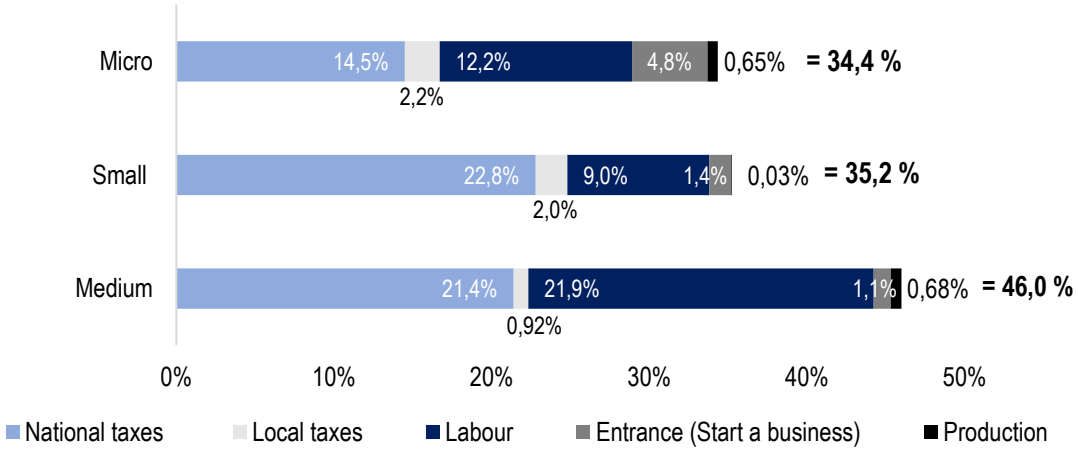
Colombian political economy led to a coexistence of economy wide pro-productivity reforms with targeted policies that inhibit resource reallocation, technology transfer and adoption and innovation. Aggregate productivity is harmed by politically related benefits to specific sectors. The study by Eslava and Meléndez (2009) shows that "in terms of 'economic' determinants, high or increasing productivity is not a main driver of policy in Colombia" and that policies tend to favor lagged sectors in terms of TFP and TFP growth. They concluded that horizontal policies, developed at the initiative of the government and with the participation of private interests, are often the ones that improve aggregate productivity (Eslava & Meléndez, 2009). Therefore, after a close collaboration with the private sector to formulate a modern policy for the productive sector, the National Government approved the National Productive Development Policy (PDP), in 2016. This Policy focused on defining instruments that target a market or government failure and are mainly horizontal, and recommends that in case of targeted policies, those should privilege the provision of sectorial public good and services. The policy also stablishes strategies for the main factors that affects firm productivity allowing the country to increase the levels of productive diversification and sophistication (Departamento Nacional de Planeación, 2016).

The Colombian Government sign sectorial pacts with the private sector to improve regulations or government programs in order to promote growth and employment. During 2019, the National Government n coordination with the private sector formulated 22 "Pacts for Growth and Employment" in the following sectors: chemistry, pharmaceutics, fashion sector, construction industry, movement industry (automotive, shipyard, and aeronautic sectors), processed food, software and IT, BPO, tourism, orange economy (cultural and creative industries), cocoa, forestry sector, meat (cattle) industry, fruits, fishing, palm, sugar cane, dairy products, mining, infrastructure, energy and hydrocarbon sector. These pacts focused on the identification of barriers in five strategic areas: competitive environment, entrepreneurship and formalization, productivity, investment, and innovation, and their respective solutions with 826 compromises in the short and medium term. To date, and in less than one year of the signature of the first pacts, 62.2 % of their actions have been finished, and 369 compromises have been accomplished.

ii. Regulatory Costs and Informality

In Colombia, the costs of being formal are high regardless of the business size. For estimating the cost of being formal, three study cases were built for different sectors, legal structures, and firm's size. The studies calculated the marginal costs to run a business in its first year of creation. As a result, the estimations show that being formal represents additional costs for being formal between 32 % and 47 % of the gross profit. The higher costs are related to comply with taxes and labor regulations.

Figure 9. Costs of being formal by firm's size



Source: DNP based on Tributary's statute, Law 1819 of 2016 and Code of Commerce.

Informality levels in the economy affects productivity through perverse incentives and an inefficient assignment of resources. Low productivity of informal enterprises is related to characteristics such as keeping a small scale to avoiding inspections by authorities, having low competitive pressure, having restrictions to easily access to credit and, as a result, low investments rates. Also, these businesses require intensive use of low qualified workforce, have less incentives to technology adoption and training, overuse natural resources, and have a restricted use of public goods (La Porta, R., & Shleifer, A., 2008; Perry, et al., 2007).

Recognizing informality as one of the main economic problems for business development, the National Government established a national policy[9] intended to promote formality in a comprehensive way among productive units (CONPES document 3956 of 2019). This aims to improve business formalization levels in the economy through actions that benefits the cost-benefit relationship of formality. This modern policy defines formality as a multidimensional and gradual process, coordinates the efforts of different entities of the Colombian Government in 65 actions for a ten-year horizon. An important number of actions have the objective of decreasing firms' registration costs and simplifying the registration of workers to social security, for instance, through a one-stop shop to open a busines (*Ventanilla Única Empresarial*) and another to register employees to social security (*Mi Seguridad Social*), as well as through the reduction of registration fees in the chambers of commerce (Departamento Nacional de Planeación, 2019).

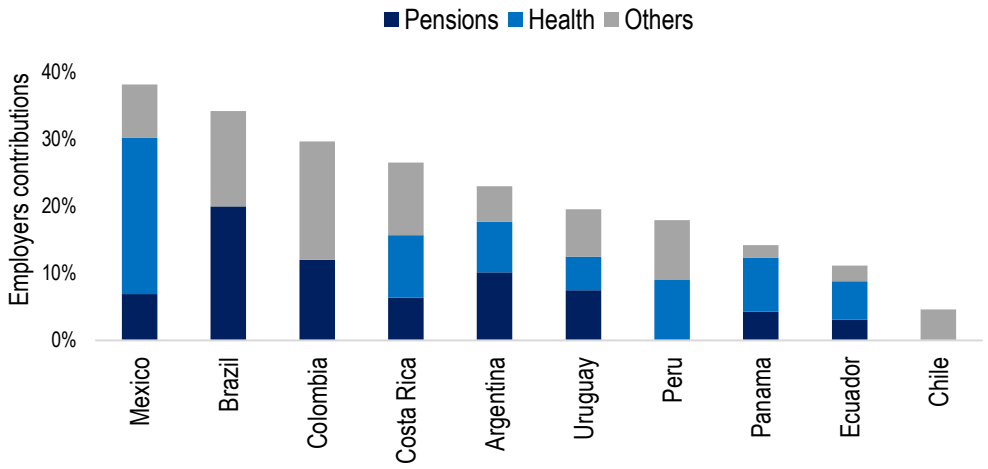
Tax compliance (filling and payment) is expensive and complex. Just in national taxes, one businessman must make around 15 payments during the year and spends around 239 hours (Banco Mundial, 2017). In other OECD countries, the average number of payments is 11 and the time required to complete it is around 163 hours (Banco Mundial, 2017). At the local level, the number of taxes and payments and the administrative burden generate additional costs of tax compliance for enterprises. Nowadays, there are 13 departmental taxes, 20 municipal taxes and at least another 24 additional contributions, without considering stamps. In addition, tax laws at a local level are not clear and, in the case of many municipalities, outdated (Comisión de Expertos para la Equidad y la Competitividad Tributaria, 2015).

Non-wage labour costs in Colombia are higher than in regional peers and the OECD average (¡Error! No se encuentra el origen de la referencia.**)** (Fernández, Villar, Gómez, & Vaca, 2017)**; reductions in these costs bring an increase in labor formalization** (ANIF, 2015)**.** One of the main evidence of the importance of changes in the labor costs was the implementation the Law 1607 of 2012, in which the non-wage labor costs were reduced

[9] Business Formalization Policy (CONPES document 3956 of 2019)

from 66 % to 52 % (ANIF, 2015). It is estimated that an increase of 1 % in non-wage labour costs reduce the labor formalization rate (workers contributing to pensions divided by economically active population) by -0.4 %.

Figure 10. Non-wage labor costs in Latin American Countries.



Source: DNP adaptation of Alaimo, Bosch, Gualavisi, & Villa (2017)
Note: "Others" include the contributions to layoffs, transport auxiliary (in Colombia), contributions to Social programs or entities supported by the State; unemployment and disability insurance.

Colombia has one of the most expensive business registration renewal fees in the world. This fee must be paid every year, depends on the assets of the firm and is much higher for small businesses. Furthermore, this renewal fee is not a common practice in other countries (Salazar, Mesa, & Navarrete, 2017).

Supporting SMEs' access to public financial resources and promote public procurement can help the international expansion of firms. Firms participating in public procurement are positively correlated to greater internalization of SMEs because this process represents an opportunity to improve their products (Cardoza, Fornes, Farber, Gonzalez Duarte, & Ruiz Gutierrez, 2016). Another way to expand firms in an international environment is to promote SMEs belonging to business groups which extends the opportunity to get resources and improves their knowledge and skills (Cardoza, Fornes, Farber, Gonzalez Duarte, & Ruiz Gutierrez, 2016). However, Colombian SMEs consider that there are obstacles in domestic's regulations and external markets' information is not enough to be in the international market.

There are challenges in inspection, oversight, and control of business informality. The inspection, oversight, and control policies are not effectively focalized. The enforcement of policies for most productive firms can have positive effects in formalization procedures without reducing the social well-being (Fernández, 2018). Currently, inspection, oversight and control activities focus just in the registered businesses, creating perverse incentives for business to remain completely informal.

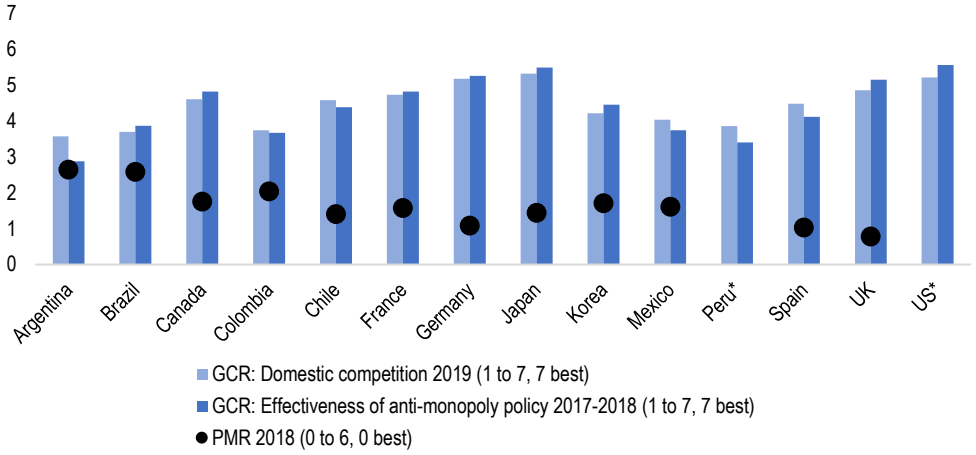
iii. Competition Policy

International comparisons characterize Colombia as a market of medium-low level economic competition. Colombia is far from the world's major economies in its level of competition, while in Latin America it only slightly exceeds Argentina and Brazil. The OECD's Product Market Regulation (PMR)[10] (OECD, 2018) for Colombia is 2.04 (index scale 0-6 maximum level of regulatory barriers to competition), higher than de OECD average of 1.38; indicating the presence of excessive regulatory barriers to firms to entry and compete in a broad

[10] The OECD Indicators of Product Market Regulation (PMR) which are an internationally comparable set of indicators that measures the degree to which policies promote or inhibit competition in product markets.

range of key policy areas; especially on simplification and evaluation of new and existing regulations and administrative burden on start-ups. Likewise, in relation to WEF's Global Competitivenes Report, the domestic market competition in Colombia could be considered low, with an index of 3.74 for year 2019 on a scale of 1 to 7 on this indicator[11], surpassing only Argentina and Brazil in Latin America. Moreover, the indicator of effectiveness of anti-monopoly policy of the WEF, the entrepreneurs consider that the antitrust policy in Colombia it is ineffective in ensuring fair competition (3.67 for year 2018 on a scale of 1 to 7) (WEF, 2019).

Figure 11. Competition indicators. Colombia vs countries.



Source: For PMR: OECD (s.f.), for GCR: WEF (2017) & (2019)
* US and Peru are not included in the PMR database.

There is a high level of market concentration in manufacturing industry. A study carried out in 2014 on the level of market concentration for 60 industrial activities in Colombia, during the period 2001 and 2010, showed that 73% of the manufacturing industry exhibits high concentration levels, 13.5% present moderate concentration levels and 13.5% low concentration. The same analysis at the departmental level showed that 45% of them have a high concentration, 25% moderate and 30% low concentration (Sáenz Castro, Páez Pérez, & Sánchez Pérez, 2014).

In the mobile internet service, it seems that consumers are benefited even in presence of relatively few providers. In 2012 the Economic Studies Group (GEE for its acronym in Spanish) of the Competition Authority -SIC- (GEE-SIC, 2012) warned about the possibility to generate more concentration in the market because of the process of spectrum assignment for 4G technology. At that time, the SIC was worried about a price increase for consumers and a disincentive to innovate and develop new technologies. In 2015, the SIC (GEE-SIC, 2015) found that the entrance of new agents to the market promoted competition and reduced leaders' market share. Nevertheless, in 2014 four enterprises had around 99% of the market. For other agents it was difficult to compete to the conditions of services offered by the leaders, in the long term this would result nonprofitable. Finally, Vélez (2019) found that a merger between two enterprises (fixed wireless internet and mobile internet enterprises) benefited consumers because they could offer bundles of services. Additionally, regarding fixed wireless internet, the GEE-SIC (2015) found the one company had a potentially dominant position in almost 70% of the states (departments) of the country.

The financial sector is a concentrated market that in the long term could generate problems. This sector has shown a concentration process since late 90s because of the increase of horizontal M&As, expansion of the business with product diversification and users increase (González, García, & Murillo, 2014). This concentration process has brought less competition between banks, which generates an oligopoly structure; which contributes

[11] WEF construct this indicator based on the perception of entrepreneurs relative to the degree of competition of the national domestic market.

to financial stability since banks take fewer risks and compete for quality and product differentiation (Castaño & Torres, 2019). However, the market concentration process in the financial sector has generated effects related to staff layoffs, contracting and remuneration differences (González, García, & Murillo, 2014). Moreover, the study found that it exists a non-linear relation (U-shape) between non-competition and stability of the system which indicates that is not healthy over time to continue with such concentrated market structures, suggesting an increased supervision of concentration processes (Castaño & Torres, 2019).

Retail distribution of liquid fuels and vehicular natural gas, a concentrated market with various M&A processes that needs attention. In relation to the final distribution of fuel, the SIC made a study in 2012 (GEE-SIC, 2012a) in which it found this market was concentrated. Distribution of fuel of three qualities (regular, extra, and diesel) had, between 2010 and 2012, two enterprises as leaders whose shares summed more than 60% for each product. The study highlights that from 1999 one of the leading companies submitted 21 merger requests, and the other one presented 15 applications. This market has had several merger processes filed in the SIC in recent years. On the other side, regarding Garcia, Velasquez & Montenegro (2014) the vehicular natural gas sector has an oligopoly competition structure in which market leader had a share of almost 50%. According to the authors, service stations owned by the leader had higher prices in comparison to the average.

The fourth market is air passenger transportation, which has been concentrated with cases of M&A, but that seems to show competition. This sector has grown in the last years because of the entrance of international and low-cost airlines and M&A processes (GEE-SIC, 2015a). In 2015, one study made by the SIC presented no signals of concentration, especially in the case of international routes. However, for national routes, the SIC found that four firms concentrate more than 90% of passengers, and just one of the them had a share of more than 55%, which means market dominance. In 2019, the delegation for the protection of competition of the SIC (Delagatura para la Protección de la Competencia-SIC, 2019) carried out another study on air transport market on domestic routes. The study found that, first, the entry of low-cost airlines does not mean a differentiated market, and that a small number of airlines and elastic demand is indicative of competition and that one of the new low-cost airlines can exert competitive pressure on the traditional ones in some routes. Between 2008 and 2018, airlines showed extensive growth for reasons such as mergers, restructuring, among others. This, in addition to the entry of new airlines, has led the decrease of Herfindahl-Hirschman Index (HHI) concentration index between 2008 and 2018 by almost 11%.

Colombian companies that face greater competitive pressure are more likely to invest in new technologies. In the Colombian case, it has been found that companies tend to adopt IT to a greater extent when optimal conditions exist regarding the profitability of the investment, the technological opportunities of the industry, the participation in foreign markets, the spillovers within the industry, the level of local competition, among others (Gallego, Gutiérrez, & Lee, 2014).

The competition authority has made efforts regarding enforcement and prevention, but they should be strengthened. Regarding the enforcement of competition laws, the unit for the protection of competition of the competition authority (SIC) opened 28 preliminary inquiries and 17 investigations between September 2018 and December 2019; closed 6 investigations; and emitted 15 motivated reports to the head of the competition authority that translated into 24 sanctions for around 65,4 million of dollars (SIC, 2020). However, there could more than 800 complaints related to competition violations in a year (SIC, 2019), but there is no detail about their prominence as a possible opening of inquiry or investigation. In relation to mergers in the period, there were 241 cases, 177 were notifications (mergers that do not comply with the obligation to ask a pre-merger study) and 52 cases that needed pre-merger study. From which, 29 were decided in phase 1 (do not present competition issues) and 23 decided in phase 2 (could have competition issues so the decision can be acceptation, objection or conditioning). Finally, 12 concepts related to mergers in the financial sector. Concerning, competition advocacy functions, in 2019 the advocacy group of the SIC issued 51 concepts; 34 had suggestions that were accepted in 23 cases of regulations. Most of the concepts were related to regulation in

the mining and energy sector, followed by trade, industry and tourism sectors, and information and communication technologies.

There is not enough independence between the Colombian Competition Authority (Superintendency of Industry and Commerce -SIC) and the National Government. Currently, the head of the Colombian Competition Authority (Superintendent) is elected by the President, who can remove the Superintendent at any time (OECD Organisation for Economic Co-operation and Development, 2018). Moreover, the many other functions carried out by the SIC (consumer protection, industrial property, surveillance of the chambers of commerce, protection of personal data, technical regulations, and legal metrology, besides competition) prevent it to dedicate its resources and efforts on competition promotion and protection (Bardey, Becerra & Cabrera (2013); CPC (2013) & Ortiz-Laverde & Soto-Pineda (2017).

The penalties imposed by restrictive competition practices are unequal for different sizes of companies and their calculation could be difficult. According to Law 1340 of 2009, fines that the SIC can impose could be up to 100,000 monthly minimum wages (USD 23.5 million) or, if it turns out to be higher, up to 150 % of the profit derived from the conduct by the offender (legal person). The maximum sanction in minimum wages, in the case of long-lasting cartels or companies with high incomes, may be insufficient to motivate economic agents to refrain from violating competition rules (Bardey, Becerra, & Cabrera, 2013). The second form of calculation is complex due to the difficulty of calculating the profits obtained by the offending companies (OECD Organisation for Economic Co-operation and Development, 2016).

The Benefits involved in the whistleblowing program (PBC for its acronym in Spanish) relies too heavily on the Superintendent, which discourages participation. The Benefits for whistleblowing (Decree 1523 of 2015) gives total or partial exoneration of the penalties for those who had participated in cartels in exchange for cooperating. However, the Superintendent can order the loss of benefits for some instigators or promoters, participants of the agreement. According to Ortiz-Laverde & Soto-Pineda (2017) this program, with its high level of discretionally, entails to the agents to build heavier collusion structures. For Neyrinck (2009), leniency programs must assure benefits and for them to be well known by possible whistleblowers.

The current system of early antitrust investigation termination through "acceptance of guarantees" allows for a penalty lower than the fine for affecting competition. The competition regime contemplates the possibility for those investigated for restrictive competition practices to offer a guarantee program through which the situation that is allegedly affecting competition is resolved. This program is reviewed by the Superintendent, who has the power to accept it or not. When the offered guarantee program is accepted, the investigation is terminated in advance. By accepting the offers, the SIC requires granting a compliance policy that can be executed if the company does not comply to the program proposed. According to Bardey, Becerra, & Cabrera (2013) this arrangement leads to two troublesome situations in which; first, the investigated does not require accepting any responsibility for the acts for which he was investigated; and second, in the event of a possible breach of the guarantees, it is an insurance company (third part) that assumes the cost.

iv. Human Capital

Colombia does not have the human capital it requires to achieve substantial improvements in its productivity. This can be explained by the existence of human capital gaps related to its quantity, relevance, and quality. Regarding quantity and relevance gaps, fewer technicians and technologists are educated in the country than those demanded by the labor market; and there is not enough consistency between the skills required by the enterprises and those provided by the educational system (Departamento Nacional de Planeación, 2016). On the other hand, there is a quality deficit in all levels of training. According to information from the Ministry of National Education, in higher education, only 8.5 % of the programs have high-quality accreditation. At the other levels of training, the lag is greater: in technical and technological education only 3.2

% of the programs have high-quality accreditation, and in work training only 8.8 % of programs have a quality certification (Departamento Nacional de Planeación, 2016).

Policy recommendations

a) Internal factors

i. Knowledge and Technology Adoption and Transfer

It is crucial for the Colombian government to implement targeted policies that increase the productivity of firms. For instance, policies that transfer capital and labor from less productive firms and sectors to a more productive ones (Carranza, et al., 2018)). Systematic dissemination of best practices among similar firms, with measurable goals of shortening their gaps is a feasible policy based on the available data (Hamann, et al., 2019). In addition, the infrastructure to design and implement such policies needs a more holistic view that would effectively link science and technology to productive activities (Eslava, Meléndez, & Perry, 2014).

Changes in the management of the technological extension program. The administration of a national program of technological extension program should be led by a single ministry, while other institutions can offer support. Moreover, having a solid evaluation system is critical for justifying the program to sponsors as well as for learning what works and does not (Youtie, Rogers, Novoa, & Escobar, 2017).

Improvements in the implementation of programs to better adopt and transfer knowledge and technology. To reduce costs when expanding these programs, group extension interventions are highly recommended. In addition, service offerings should be structured to save costs, operational efficiencies, strategic assistance, and technology that can generate new sales. A national network could help strengthen the capacity of each external consultant "extension agent" and increase consistency of services between them (Youtie, Rogers, Novoa, & Escobar, 2017). Additionally, the peer-review of the PDP recommends that Colombia would also benefit from defining targeted mechanisms to connect businesses with the industrial ecosystems of the country, for instance through partnerships with large firms and research centers across the country (OECD/UN/UNIDO, 2019). Finally, programs that provide advice to companies on management practices and continuous improvement methodologies (KAIZEN, LEAN, SIX SIGMA) should be strengthened.

Guidelines for technological adoption, particularly on issues related to Industry 4.0, should be included in the National Policy on Science, Technology, and Innovation. The Ministry of Science Technology and Innovation, together with DNP must introduce the guidelines, recommendations and policy actions related to the promotion and adoption of mature technologies and Industry 4.0 in the new STI National Policy. The policy document should clearly contemplate responsible agencies and budgets regarding four actions: adoption of mature and advanced technologies by companies, adoption of mature and advanced technologies by the State, promotion of innovation related to Industry 4.0 and development of regulatory framework.

ii. R&D and STI expenditure

The national Government should foster Public Procurement for Innovation. In Colombia, public purchases represent approximately 12% of GDP (OECD/UN/UNIDO, 2019). It is projected that, if 1% of the public procurement budget were allocated to CPI, the national STI expenditure would increase around 17.1% (BID, 2020).

The national Government should continue implementing the ArCo Methodology. The ArCo Methodology was designed in 2019 by DNP to assess the design, implementation, and governance of Competitiveness and

Innovation policy instruments following international good practices[12]. Through this methodology, it was found that current instruments exhibit low efficiency and efficacy.

Bancóldex should develop a concessionary credit line to leverage private sector innovation projects. The credit market for innovation activities requires the development of new financial instruments (Minciencias, 2018). The preferential conditions of this line would be achieved through a contribution of non-reimbursable resources made by entities of the National Government interested in its development. A contribution of USD 8.78 million is proposed to leverage a line of credit for USD 160.73 million (Bancóldex, 2020).

iii. Quality in the Productive Process and Quality Infrastructure

Create an environment to expand the demand and supply of quality services. It is important to introduce incentives for companies to get quality certificates, for example by requiring that public procurement prioritize products that comply with quality standards (Ministry of Economy & Finance, Korea & KDI, 2018). Furthermore, teamwork among laboratories in different regions should be encouraged to provide test and calibration services where local demand may not be high enough to justify establishing laboratories (OECD/UN/UNIDO, 2019).

Encourage companies to participate in national services for quality. Encourage the utilization of standards by the Government and systematically promote quality improvement of Colombian products, pulling up the demand for conformity assessment services (Ministry of Economy & Finance, Korea & KDI, 2018). To promote leading firms to use national quality infrastructure, more rigorous test and calibration processes are needed to ensure that accuracy, reliability, and traceability of measurements match international standards. A good example for Colombia to follow is the German model that is known for its capacity to articulate public and private institutions for giving metrology, innovation, and services to firms (OECD/UN/UNIDO, 2019).

Promotion of programs to improve the technical capacity of the human capital that provides quality services. To reduce the human capital gaps in the processes of the testing and calibration laboratories, it is recommended to create new and strengthen metrology education programs, as well as establish alliances with international institutes for advanced training in metrology to solve knowledge deficiencies (Ministerio del Trabajo & OEI, 2020). On the other hand, it is recommended to include in the program for linking professionals with a doctorate degree led by the Ministry of Science, Technology and Innovation to regulatory entities so that they can support them in issuing technical regulations (Fedesarrollo, 2013).

b) External factors

i. Political Economy of the Colombian Policy Making Process

Design instruments and programs based on evidence. PDP clearly establishes the formulation of programs and design of instruments should be in close coordination not only with the private sector but also among all levels of the public in sectors (Departamento Nacional de Planeación, 2016). In addition, the peer review of the PDP conducted by the OECD in 2018 recommended that defining policies based on evidence, as the PDP has done, is a good practice, but international experience shows that, in defining priorities for a national strategy for industrial and production development, a challenge-driven and place-based approach works better (OECD/UN/UNIDO, 2019).

Recommendations by the private sector to dynamize the economy in a Post-COVID19 era. The Colombian biggest business association (*Asociación Nacional de Empresarios* – ANDI, by its Spanish acronym) proposed ten strategies with the goal of favoring the Colombian industry. The ten strategies are focused on: sectoral and

[12] More information about the ArCo methodology at: https://www.dnp.gov.co/programas/desarrollo-empresarial/Competitividad/Paginas/Metodologia-de-Articulacion-ArCo.aspx

business development policies, public procurement program, campaign to promote national purchases, strengthening of local supply chains, business rescue plan, liquidity and financial strengthening, defense against unfair trade practices in international trade, search for new international opportunities, creation of conditions for new business investments, and revitalization of existing projects, especially infrastructure (ANDI, 2020). Some of these recommendations are already being implemented at the national level, other need to be discussed.

ii. Regulatory Costs and Informality

Revision of the costs that involves the process of being a formal enterprise. Strategies to incentivize formalization can include a reduction of renovation taxes for business registration (Salazar, Mesa, & Navarrete, 2017). A new proposal of cutting some non-wage costs such as the contribution to *Cajas de Compensación Familiar* at least in zones in which they do not have geographic outreach. An option to contribute for less than a month (e.g. hours or days) to health and pension systems (ANIF, 2015). For 2020, the Ministry of Labour is in charge of proposing a law that modernizes the way of hiring formal workers taking into account income and population conditions (Departamento Nacional de Planeación, 2019). Finally, it is important to continue the efforts on implementing Regulatory Impact Assessment at the national level (Departamento National de Planeación, 2019).

Design a new enforcement strategy to disincentivize informality. This strategy must include a risks matrix in which factors such as enterprise age of the entrepreneur, size, sector, location, among other factors, need to be considered to focus the efforts of institutions to enforce their policies (Fernández, 2018).

iii. Competition Policy

Changes in the institutional framework. First, the Superintendent's choosing process must be separated from the direct election of the Executive Branch (Ortiz-Laverde &Soto-Pineda (2017) & OECD (2018)). Second, the creation of a committee in charge of the judgment and sanctions (Ortiz-Laverde &Soto-Pineda (2017) & CPC (2013)). Third, adopt regulations to avoid communication between the Superintendent and the Deputy Superintendent OECD (2018). And, fourth, evaluate the possibility to separate the SIC into two different entities (CPC Consejo Privado de Competitividad, 2013).

Modifications to the Benefits of the whistleblowing Program. Colombia has to eliminate the requirement that the benefits of the leniency program are not for the instigator or promoter (OECD Organisation for Economic Co-operation and Development, 2016). In the case of a civil suit for damages caused by a cartel, a beneficiary of the Program should only be responsible for its share of the damages and not for the whole damage caused by the cartel (OECD Organisation for Economic Co-operation and Development, 2016).

Regulation of the process of acceptance of guarantees by establishing its characteristics, requirements, and procedures. The regulation needs to clearly state the procedure for third parties participation, publication of the scheme of guarantees proposed for public assessment, minimum criteria for the guarantees proposed, and assure that in case of breach of the guarantees the agent response by its ways for the penalty and not by an insurance company.

Establishment of a broader range of options to calculate the enterprises' penalty that affect the competition. This could be based on a percentage of the enterprise's sales (OECD Organisation for Economic Co-operation and Development, 2016), operating income, or equity.

It is necessary to conduct a study for Colombia that determines which has been the tendency of the market concentration at a national level as a degree of competition indicator. It is evident the need of studies related to concentration and market power at an aggregate level because there are only sectorial studies as cited in this document. According to some papers made for the United States, a study that estimates market

concentration must include an analysis of variables like market share measured in function of sales, markups, number of enterprises evolution, among others. Besides, it would add great value if there is a differentiation between national and subnational dynamics, and between the different economic activities and the market aggregated. Some international authors that could conduct this study are Philippe Aghion, Esteban Rossi-Hansberg, and Thomas Philippon because they make part of the authors that have developed investigations as proposed in this recommendation, and some national authors that have done some research in competition and also can make this study are David Bardey and Marcela Meléndez.

iv. Human Capital

Ensure that education and work training are relevant to the productive sector. The National System of Tertiary Education and its National Qualifications Framework must be aligned to the needs identified by the productive sector. Moreover, it is imperative for the government to promote competency-based management of human resources by employers on-the-job training. In addition, Colombia must prioritize the offer of comprehensive vocational training programs at the departmental level in those skills that are demanded by the productive sectors. Finally, it is required the definition of a competency certification scheme by applying standardized quality processes (Departamento Nacional de Planeación, 2016).

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Productive Development Policy (document CONPES 3866)

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Colombia's low levels of productivity are explained mostly by factors affecting firms' decisions and performance. These factors are both internal to the firms, such us poor technology adoption; low levels of innovation, R&D and STI expenditure, and adoption of quality standards; and external ones, like high regulatory burden and business informality; low levels of competition; and gaps of quantity, relevance, and quality of human capital (Departamento Nacional de Planeación, 2020).

In 2016 the government approved the Productive Development Policy (document CONPES 3866). The goal of this policy is to increase productivity and diversify the Colombian economy towards more sophisticated and high value-added sectors (Departamento Nacional de Planeación, 2016). Principles:

- **Regional approach**: The PDP prioritizes different sectors based on comparative advantages and productive capacities. These were done in each region and through participatory processes that leverage local knowledge and experience.
- **Coordination Intensive**: The PDP involves strong coordination mechanisms between government, the private sector, and academia, as well as within the public sector.
- **Based on evidence**: Policy instruments must have proven effectiveness and efficiency through empirical evidence or pilot programs.
- **Interventions**: Policy instruments should be designed to solve market, coordination, and government failures (horizontal market interventions and sectorial public goods).

	Horizontal	Vertical
Public goods	× Infrastructure concessions × Consumer protection through legal metrology × National defense × Property rights	✓ Coffee Research Center (Cenicafé) ✓ Laboratories to evaluate compliance with sanitary and phytosanitary measures ✓ Vocational training in metrology ✓ National Qualifications Framework for the metalworking industry
Market interventions	✓ Manufacturing Extension Program ✓ Financing instruments for innovative companies ✓ Mentoring and training for entrepreneurs ✓ Subsidies for investment in technological equipment	× Financing instruments for companies of specific industries × Tax deductions for the hotel industry × Assistance to productive units × Consultancy of Crafts of Colombia to craftsmen

Note: ✓: Recommended interventions, X: Not recommended interventions. Source:

During 2018, OCDE, UN and UNIDO conducted a peer review aiming at reviewing strengths, weaknesses, and challenges of the PDP with a focus on the institutional framework, instruments, prioritization strategy, and preliminary results. The recommendations are: strengthening planning capacities of the Government, harnessing the potential of productivity in all regions, and activation of mechanisms to benefit more from trade and investment (OECD/UN/UNIDO, 2019).

Regarding the last recommendation of the OCDE Peer Review of the PDP, the specific recommendations are:

- Advancing in achieving export diversification by benefiting more from regional integration and improving its participation in global value chains (GVCs).
- Continue modernizing the quality infrastructure to enable domestic firms to operate in an Industry 4.0 and fast-changing industrial landscape.
- Increasing strategic co-ordination between industrial development, trade, and investment policies.

Based on the PDP principle of designing policy instruments to solve market, coordination, and government failures, the Articulation for Competitiveness methodology (ArCo) was designed in 2019 by DNP. ArCo helps to assess the design, implementation, and governance of competitiveness and innovation policy instruments in Colombia following international good practices (Departamento Nacional de Planeación, 2020). Through this methodology, it was found that current instruments exhibit low efficiency and efficacy:

- First, the institutional offer of the national government is highly atomized: more than 600 public interventions have been identified and 50 % of them have less than USD 278.523 suggesting a low scale of impact[13].
- Second, public interventions identified do not have an adequate user segmentation and exhibit issues related to duplication of efforts. Among them, 65% have three or more target users which could be an indication of focalization problems.
- Third, in the field of internationalization, 24 public intervention instruments were identified at six national government entities. These instruments provide assistance to companies for achieving better access to international markets, preparing their products or services, or receiving foreign investment.
- Fourth, it was not found a single instrument revealing interventions aimed at promoting investments abroad. Hence, it can be inferred that there is an opportunity to develop programs for domestic investors.
- Fifth, the Trade, Industry and Tourism sector accounts for 88 % of internationalization instruments and allocates nearly USD 6.2 million for the implementation of these interventions[14]. This accounts for 66 % of the financial resources identified for strengthening business internationalization, nevertheless 15 instruments have no budget allocated. Among the internationalization instruments of this sector, 58 % of them are sectoral market interventions, suggesting an inadequate emphasis on the use of resources.

The cluster initiatives as a tool to boost PDP goals. Clusters initiatives are a way to generate strategies of sophistication, increase added value in products of the companies that participate in them; insertion in new markets and regional and global value chains; diversification of exports; increasing productivity and knowledge and technology transfer in small firms of the productive chain. The National Development Plan 2018-2022 establishes that the above requires the generation of enabling conditions and the provision of public goods for its development as well as the supply of competent human capital, support for sophistication and diversification of its offer through innovation, modern regulation, a free competition environment, and a monitoring, measurement, and evaluation system (Departamento Nacional de Planeación, 2019). According to the Ministry of Trade, Industry and Tourism, the country has more than 25 cluster initiatives, including: fish farming, tourism, snacks, construction, aeronautical and bioenergy sectors, and the Knowledge-based services cluster will soon be launched.

International comparisons characterize Colombia as a market of medium-low level economic competition and studies show some concentrated sectors. The OECD's Product Market Regulation (PMR)[15] (OECD, 2018) for Colombia is 2.04 (index scale 0-6 maximum level of regulatory barriers to competition), higher than de OECD average of 1.38. This score indicates the presence of excessive regulatory barriers to firms to entry and compete in a broad range of key policy areas; especially on simplification and evaluation of new and existing regulations and administrative burden on start-ups. Likewise, in the WEF's Global Competitivenes Report, the domestic market competition in Colombia could be considered low, with an index of 3.74 for year

[13] Exchange rate 1 USD = 3.590,37 COP on February 24th, 2021.

[14] Ibid.

[15] The OECD Indicators of Product Market Regulation (PMR) which are an internationally comparable set of indicators that measures the degree to which policies promote or inhibit competition in product markets.

2019 on a scale of 1 to 7[16], surpassing only Argentina and Brazil in Latin America. Regarding specific sectors, a study carried out in 2014 on the level of market concentration for 60 industrial activities in Colombia during the period 2001 and 2010, showed that 73% of the manufacturing industry exhibits high concentration levels, 13.5% present moderate concentration levels and 13.5% low concentration (Sáenz Castro, Páez Pérez, & Sánchez Pérez, 2014). In the mobile internet service, in 2012 the Economic Studies Group (GEE for its acronym in Spanish) of the Competition Authority -SIC- (GEE-SIC, 2012) warned about the possibility to generate more concentration in the market because of the process of spectrum assignment for 4G technology. The financial sector has shown a concentration process since late '90s because of the increase of horizontal mergers and acquisitions, expansion of the business with product diversification and users increase (González, García, & Murillo, 2014). This concentration process has brought less competition between banks, which generates an oligopoly structure; that contributes to financial stability since banks take fewer risks and compete for quality and product differentiation (Castaño & Torres, 2019).

In competition, a study for the Internationalization Mission found that in manufacturing sector top decile plants in markup and operational profitability distributions are less productive and less willing to invest in ICT related equipment when compared with the rest of plants (Iootty, Pop, Pena, & Stinshoff, 2021)**.** The economic sectors related to these findings are clothing, beverages, furniture, manufacture of other non-metallic mineral products, and textiles, and the study confirms that some of them are among those with the highest average ad-valorem equivalent of tariffs and non-tariff measures in the country. So, it can be thought that its high benefits are due more to a strategic behavior and not to the result of efficiency in production processes; which could represent a sign of lack of competition. Therefore, carrying out an in-depth evaluation of competition in those manufacturing sectors is highly recommended to evaluate their characteristics and identify how state intervention can restrict the entry of companies, protect dominant firms, among others. In addition, the study recommends to assess regulatory restrictions that might still deter entry, reinforce dominance or protect vested interests in markets where competition pressure is weak; whether the government has been fostering competitive neutrality between State-Owned Enterprises and private firms – not only in network sectors but in other commercial sectors where they compete; whether public aid has been granted in a non-distortive way; and whether the competition policy and law enforcement has been effective to tackle anticompetitive behavior and distortive regulations (Iootty, Pop, Pena, & Stinshoff, 2021).

Regarding the quality infrastructure[17], there is evidence of its relationship with export performance and the need of a good availability of services for the improvement of product's quality. The dynamics of product quality changes, highlights the tradeoff between risk and return in quality improvements in exporting countries. Krishna, et.al (2020) find empirical evidence of a strong positive correlation between the mean and the variance of quality growth[18], consistent with a risk-return tradeoff. However, in developing countries like Colombia, local companies tend to demand services providers abroad to support and improve the quality of their products and processes to meet the needs of their international clients due to the unavailability or unacceptable results of some of these services found at the national level (calibration laboratories, auditors and certifiers) (ONUDI, 2020).

The study about quality standards, productivity and exports made for the Internationalization Mission found a positive relationship between the adoption of quality standards and productivity (Departamento Nacional de Planeación, 2020). The study recommends to apply a qualitative method to determine and better understand the transmission mechanisms of the relationships found between quality standards compliance and

[16] WEF construct this indicator based on the perception of entrepreneurs relative to the degree of competition of the national domestic market.

[17] The term "quality infrastructure" refers to the set of organizations (public and private), policies, regulatory framework and practices necessary to support and improve the quality and safety of goods, services and processes (ONUDI, 2020).

[18] The authors use product unit values (trade value divided by trade quantity) as a proxy for product quality of exported products to the US from 1989 and 2001.

productivity, and to identify the restrictions that companies face to increase Total Factor Productivity (TFP) and the way in which they adopt quality standards (Departamento Nacional de Planeación, 2020).

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Annex – Business Demography

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The majority of Colombian firms (legal entities) in Colombia are considered micro and small companies (93.5 % in 2019), under national classifications based on assets and employment. Moreover, as shown in Table 1, a total of 1,161,362 companies were registered as natural persons (71 % of the total) in 2019, including Most of the registered companies in the country are engaged in the provision of services (44,3 %) and in activities related to retail (37,6 %) and the other 18% are related to manufacturing activities. (Figure 1).

Table 1. Registered enterprises by size and business type, 2019

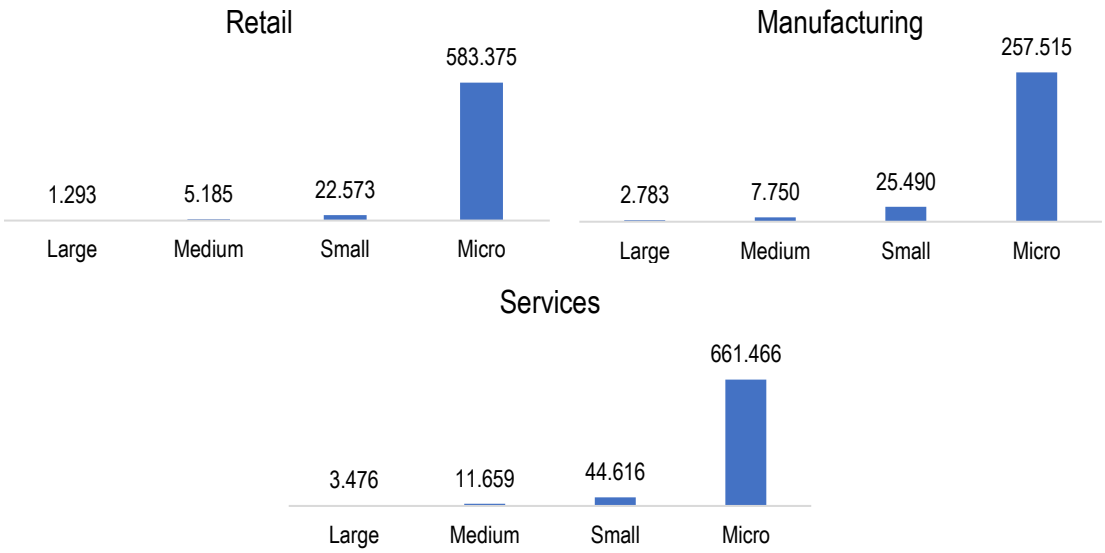
Size	Natural person		Legal entity		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Micro	1,150,196	99.04 %	357,888	75.87 %	1,508,084	92.35 %
Small	9,729	0.84 %	83,022	17.60 %	92,751	5.68 %
Medium	1,279	0.11 %	23,333	4.95 %	24,612	1.51 %
Large	158	0.01 %	7,476	1.58 %	7,634	0.47 %
Total	1,161,362	100 %	471,719	100 %	1,633,081	100 %

Source: *Registro Único Empresarial y Social* (RUES).

Note: Business sizes according to previous classification, based on assets: Firms are considered Microenterprises up to 500 monthly legal minimum wages (SMLMV by its Spanish acronym), Small for assets between 500 and 5,000 SMLMV, Medium between 5,000 to 30,000 SMLMV, and large more than 30,000 SMLMV in assets (1 SMLMV 2020 = 877.803 COP, around 241,25 USD for 2020)[19].

Figure 1. Registered enterprises by sector and business size, 2019

[19] The current classification is from December of 2019 and classifies enterprises according to the earnings of the firm and their business activity (commerce, services, and manufacturing). This classification scheme is not yet applicable due to the poor information available about enterprises' earnings reported to the chambers of commerce (administrators of RUES).



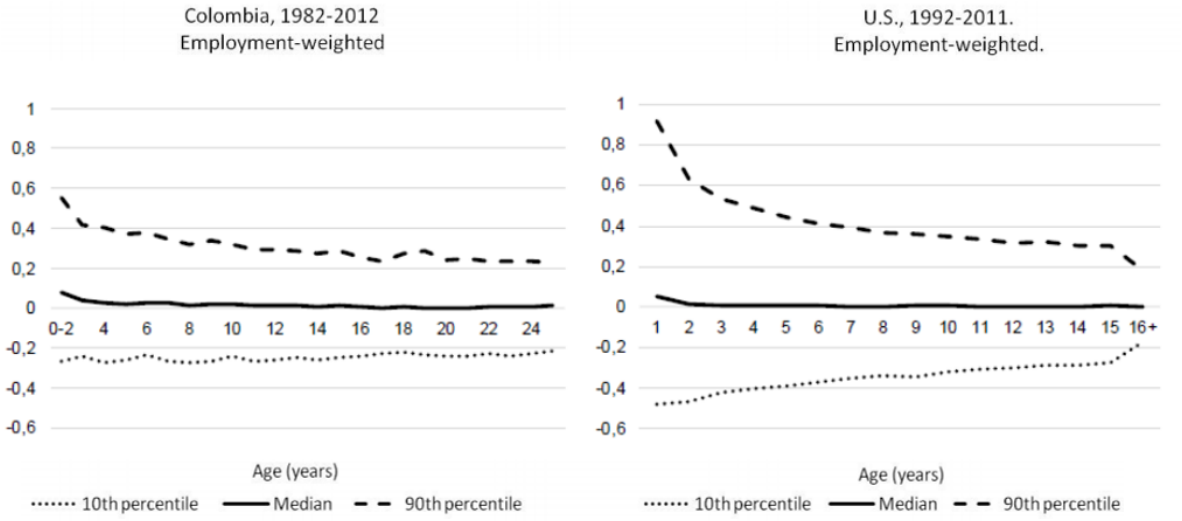
Source: *Registro Único Empresarial y Social* (RUES).

Performance of Colombian firms is heterogeneous along time and across business size. According to data of Colombian manufacturing firms between 1982 and 2012, on average revenue grows four-fold after 25 years of firm existence. Regarding employment, the average firm doubles its number of workers after 10 years and increases employment three-fold after 25 years. However, the average firm does not raise its physical productivity (TFPQ) and after 25 years it remains similar to the one it had the year of its creation (Eslava & Haltiwanger, 2020). Another study conducted by the World Bank (2014) using its Enterprise Surveys finds that the companies covered by the Enterprise Surveys are five times larger at the age of 15 years or more than those between 1 to 5 years, whereas Eslava and Haltiwanger found that the size of these firms barely doubled by the same age (World Bank, 2014).

The lack of dynamic high-growth entrepreneurship is a likely a source of the development differentials between Colombia and the U.S. (Eslava, Haltiwanger, & Pinzón, 2019). The study focuses on manufacturing firms, with data from 1982 to 2012 for Colombia and a slightly shorter period for the US. Given data constraints for Colombia, for the most part, the paper is limited to units of ten or more employees. Colombian and US companies have highly skewed distributions of employment growth; faster growth in young establishments compared to old ones; negligible median growth at any age; and aggregate employment creation entirely attributable to the entry of new establishments over the course of five years.

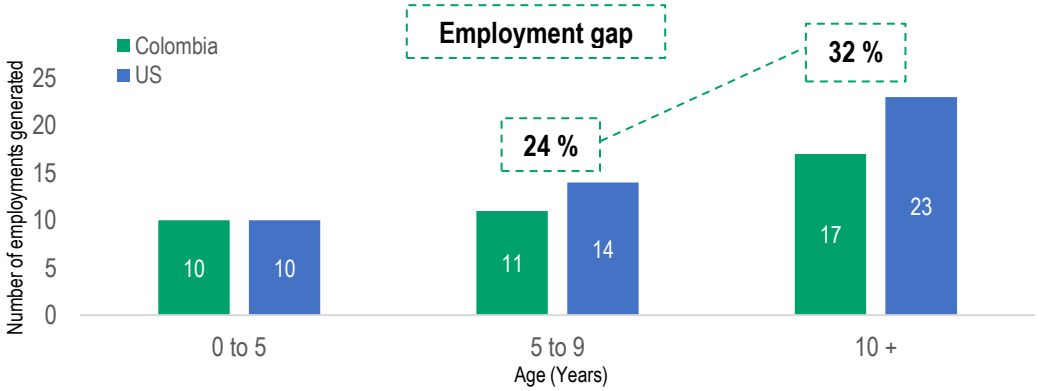
In Colombia highly-productive firms grow slower than in the US, while the least productive firms survive longer. The article of Eslava, Haltiwanger, & Pinzón (2019) also exhibits less distance with respect to laggard establishments, which despite their poor performance are more likely to survive longer than similarly slow growers in the U.S. Furthermore, Colombian 90th percentile of business does not exhibit the spectacular employment growth that young superstars display in the U.S. The 90th-50th and 90th-10th ranges in the U.S. almost double those in Colombia for ages one to five (Figure 2). As a result of the less marked up-or-out dynamics in Colombia, especially in terms of growth at the upper end of the distribution, the size-age distribution displays a larger concentration on old and small establishments. Also, average employment growth over a firm's life cycle is slower in Colombia (Figure 3). Thus, a greater fraction of firms and employment correspond to micro firms in Colombia, perhaps the most salient difference between Colombian manufacturing vs. the U.S.

Figure 2. Distribution of employment growth rates for continuers



Source: (Eslava, Haltiwanger, & Pinzón, 2019).

Figure 3. Enterprises growth comparison (2002 -2012).



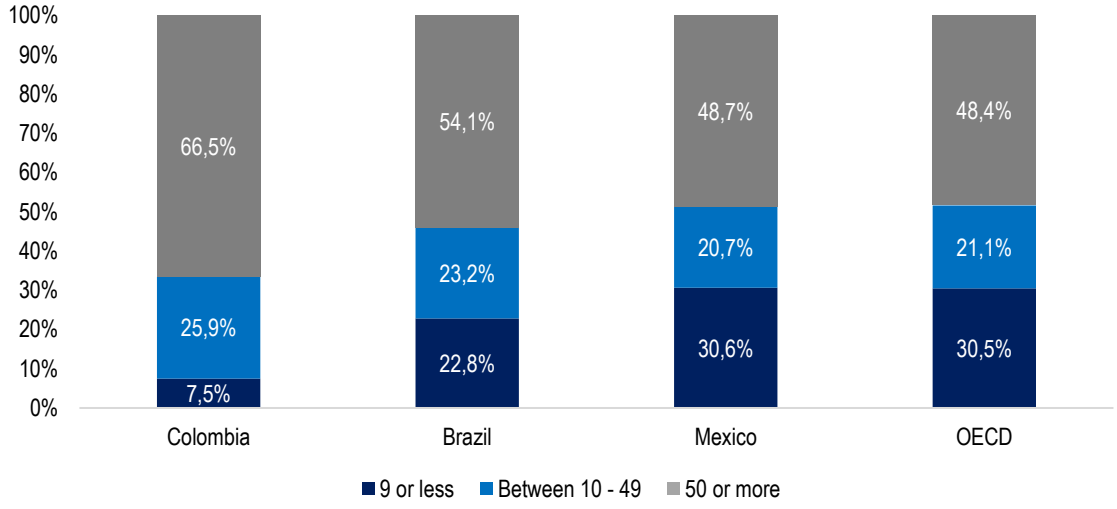
Source: DNP with data of (Eslava, Haltiwanger, & Pinzón, 2019).

Internal dimensions of young businesses are even more important than size-to-productivity wedges. The focus has frequently been on efforts conducive to improvements in technical efficiency, such as research on managerial practices (production processes and employee management) that impact productivity. However, it is important also to consider additional matters, for instance, the way business appeal to customers, the input prices, and how the business enhance quality (Eslava & Haltiwanger, 2020).

Financial shocks have a significant and longer impact on the growth of sales and assets and varies across firm size. Galindo and Meléndez (2013) used data from the Superintendence of Companies (regulator of commercial businesses, generally referred to as SuperSociedades) between 2000 and 2010 and show that firms had greater sales growth than large ones However, the assets growth was poor for all firms regardless of their size, but better in the larger enterprises than in smaller ones (1.8 % against 1.4 % respectively). The paper found that the impact of positive financial shocks (more credit), measured as the ratio of debt to assets, is stronger for larger firms and for the most productive ones that export. Using panel vector autoregressive models, Galindo and Meléndez (2013) estimated that the cumulative average effect (after 6 years) of a 10 % financial shock on sales growth were of 0.3, 2.5, and 8.9 p.p. for small, medium, and large firms, respectively. According to the authors, the possible explanations are the differential conditions under which credit is granted across firm sizes and factors lacking in small firms that are complementary to financing and just as necessary for firm growth (Galindo & Meléndez, 2013).

In Colombia, there is a considerable number of self-employers which rarely become employers and formal employment is abnormally concentrated in big companies. According to a study by the World Bank, on average, 28.8 % of income earners in Latin America and the Caribbean (LAC) are self-employed or small employers. In Colombia only 0.3 % of the self-employed became employers over a three-year period in contrast to less than 0.4 % of income earners in LAC who own a business employing 50 workers or more (World Bank, 2014). For Colombian microenterprises, which account for 94.5 % of the total registered firms in Colombia, they only generate 7,5 % of the formal employment. This contrasts with the average for OCDE countries in which microenterprises (91 % of the total businesses) account for 30.5 % of the formal employment (Graphic 2). Comparing with Latin American peers, the amount of formal employment by microenterprises in Colombia is a third of that in Brazil (22.8 %) and a quarter than that in Mexico (30.6 %) (Consejo Privado de Competitividad, 2019). Moreover, a Central Bank of Colombia study that analyzed data from the Annual Manufacturing Survey between 2000 – 2016 concluded that, over the long-term, formal employment grows at a slower rate than total employment. The study showed that the number of employed people in this sector grew nearly 35 % while the total payroll grew 28 % (Carranza, et al., 2018).

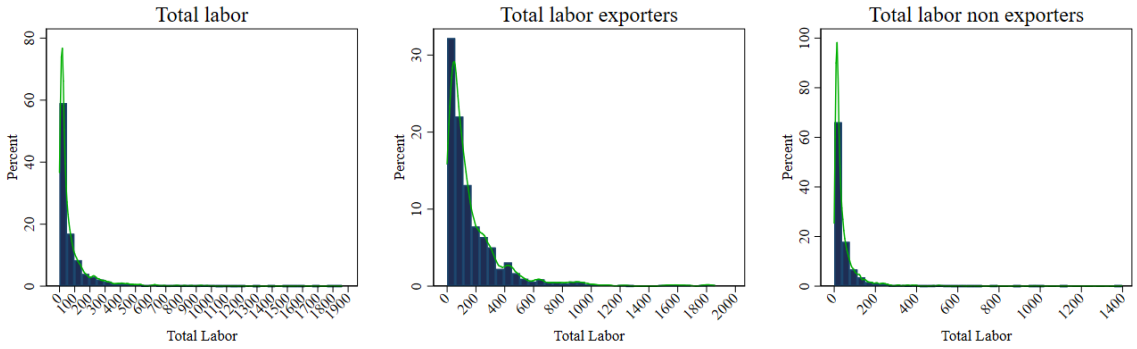
Figure 4. Formal employment distribution according to firms' number of employees, 2018.



Source: (Consejo Privado de Competitividad, 2019).

In the manufacturing industry in Colombia labour force is also concentrated in small business, but labour force in exporters are not as concentrated as in non-exporters. The distribution of labour force among manufacturing industry in Colombia is heavily concentrated: 75 % of the labour force works in establishments with 92 employees or less. Moreover, this level of concentration is even bigger in non-exporters. In 2018, 75 % of labour force in exporters establishments works in plants with 225 employees or less while the same 75 % in non-exporters plants works in plant with 52 employees or less.

Figure 5. Formal employment distribution of manufacturing exporters and non-exporters, 2018.



Source: DNP with data from Annual Manufacturing Survey, DANE 2018.

One of the factors that could explain the lack of formal employment in small to medium business is the aversion to invest in research and development (R&D). A study of the Inter-American Development Bank for Latin America concludes that firms that invest in knowledge combine internal capacities with innovations. The authors highlight that internal capacities require abilities to absorb technology. Finally, the study found that the typical multinational firm operating in Latin America is both less prone to invest locally in R&D and also less likely to innovate (Crespi, Ezequiel, & Vargas, 2016).

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