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The Effect of Foreign Direct Investment on Colombia's Economic Growth and the Role of Human Capital: Does Foreign Direct Investment Foster Growth?

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Abstract: Since the pioneering work of John H. Dunning on the role of foreign direct investment (FDI) in the economic growth of the United Kingdom, many experts have debated the growth effect of FDI in an economy. This study investigated the impact of FDI on Colombia's economic growth from 1990 to 2019. Moreover, it explored whether the Colombian economy has benefited from positive spillover from FDIs. Additionally, the paper examined how the stock level of human capital conditioned the effect of FDI on GDP per capita growth. To this end, the analysis separated tertiary enrollments from the human capital index, and mediation analysis tests of human capital and tertiary enrollments were performed on FDI and GDP per capita. The results show that only 2% of FDIs were mediated through human capital, whereas the mediation effect rose to 25% when using the tertiary enrollments.

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Introduction

Despite recent setbacks resulting from populist movements in many Western and non Western countries, the ongoing trend toward globalization will almost certainly prevail. One of the most significant aspects of "economic globalization is the increased flows of foreign direct investments [FDI]" (Kalin, 2009, p.2). Moreover, FDI is increasingly viewed as a viable conduit and cost-effective way to access advanced technologies, reduce unemployment, and foster economic growth. Therefore, "Through the generation of knowledge spillovers, foreign direct investment (FDI) in developing countries is widely accepted as a catalyst for productivity gains and improvements in efficiency for domestic firms, [through] … infrastructures, legal systems, and governance" (Moralles et al. 2020, p.257). Additionally, FDI constitutes an essential channel for attracting foreign capital to revitalize anemic local economies because it "promotes economic growth by facilitating capital formation, enabling technological spillover and improving productivity" (Weijun et al. 2020, p.2594). Global FDI inflows have increased "by 17% annually in the developing countries [during the late 1980s]. [and by] … 1993 a total of US$70 billion was allocated to developing countries …" (Ramzan et al. 2019, p. 338). Furthermore, the United Nations Conference on Trade and Development (UNCTAD) has estimated that FDI increased "from US$55 billion to US$1,800 billion between 1980 and 2017" (Ramzan et al. 2019, p. 338). Despite the UNCTAD (2018) report claiming a decline in worldwide FDI, the flow of FDI in developing countries increased from 36% in 2016 to 47% in 2017, according to Demena et al. (2019).

The availability of private foreign capital has convinced policymakers around the globe and notably in Colombia to enact business-friendly legislations to attract multinational corporations (MNCs). In addition, large private transnational enterprises (MNCs) are viewed as "the main producers and organizers of the knowledge-based assets that are primarily responsible for advancing global economic prosperity, and they are the principal cross-border disseminators of the fruits of these assets" (Dunning, 1994, p. 212). Similar to many other countries, FDIs in Colombia have progressed through various

periods, however, three distinct phases can be identified. The pre-1991 period, which was characterized by import substitution and the prevalence of FDI restrictions. However, the post-1991 era witnessed a change in this attitude, and meaningful amendments to the constitution were enacted to usher in a period of economic liberalization to attract FDI. Consequently, following the financial crisis of 2008, Colombia began a new phase that aimed at attracting high growth and high value-added FDI.

Accordingly, the purpose of this study is to answer two important questions:

(1) Does FDI foster economic growth?

(2) How did human capital channel the growth effect of FDI through the Colombian economy?

The principal justifications proposed by Colombia and other host countries to explain their efforts at attracting FDI, in addition to economic growth, are the possibility of technological spillovers through the transfer of new managerial skills to the local workforce, who will ultimately disseminate those skills to other local companies. Hence, this study hypothesized that FDI would contribute to economic growth if an economy met at least one condition: the availability of a sufficiently educated workforce. The availability of a sufficiently skilled labor force is essential for a country to be competitive in attracting foreign capital in high growth and technologically advanced industries. Because knowledge spillover tends to be larger in more advanced industries, host countries with a well-educated workforce are likely to benefit from FDI (Kalin, 2009). Moreover, "such knowledge transfer requires a host country [to have sufficiently] absorptive capacity … [and, local] companies close to the technological frontier [to] have a greater potential to absorb knowledge and enhance their productivity" (Moralles et al. 2020, p.257). As a result, "FDI can be considered a source of knowledge for the host economy and … [help] fostering the economic development of the recipient country … it enables the emerging market firms to diversify from home resource dependence, thereby improving their profitability" (Moralles et al. 2020, p.257). However, according to Moralles et al. (2020), absorptive capacity is not a binary concept. Moreover, using the threshold regressions of Hansen (2000), Girma (2005) found that productivity spillovers from

FDI can be negligible or even negative, which she considered to be evidence of a nonlinear threshold associated with a minimum level of absorptive capacity. Moralles et al. (2020) concluded that "negative spillovers may be caused by low absorptive capacity triggered by insufficient cognitive capital" (p. 258).

According to the UNCTAD report (2006), Colombia has a relatively well-skilled workforce operating at a low cost and at management level, which explains why Colombia has escaped the negative spillover trap and registered a relatively high level of economic growth since 2000. Since a sufficiently skilled workforce is necessary for a host country to benefit from FDI, Colombia is well positioned to attract and benefit from FDIs. My research is particularly exciting given the seemingly diverging views among economists on the role of human capital and the impact of FDI on economic growth. Past studies have mostly agreed on the mechanism of FDI; however, they have fallen short of providing a definitive answer to the first research question. I hope that this study helps to definitively alleviate any remaining doubts as to whether FDI contributes to economic growth and further identifies its differing channels and the intensity of its impact.

I. Literature Review

A. Causal Link Between Foreign Direct Investment and Economic Growth

FDI is defined as "an investment by a firm from one (home) country to another (host) country, where the foreign investor owns at least 10% of the company in which the investment is made" (Kalin, 2009, p. 3). MNCs are the main drivers and beneficiaries of the globalization process. To maintain and enhance their competitiveness, they adopt an integrative system that links their supply line to their manufacturing facilities while reducing their production costs. Moreover, the FDI literature recognizes that to reach the level of efficiency, foreign and local companies must cooperate and be located in close proximity to each other forming a cluster of companies (Moralles et al., 2020). FDIs can reach the host

countries' markets through several conduits. Greenfield investments are the construction of a new plant with its production abroad, whereas brownfield investments are when a foreign company acquires an existing local firm (Kalin, 2009). Furthermore, an FDI can take "the form of a joint venture, which implies a partnership between the foreign firm … [and one] from the host country" (Kalin, 2009, p. 3). According to the Eclectic Paradigm also known as the OLI theory developed by Dunning (1994), "a firm must own three advantages over local firms to take on FDI" (Kalin, 2009, p. 4). First, ownership, which derives from firm-specific assets such as technology, managerial skills, patents, and brand names. Second, location, that is, the host country must allow the MNCs to produce their goods more profitably in that location than in their home countries. Moreover, the "economic, institutional, and political characteristic of the [host] country … as well as [its] market size and [the] cost of resources" (Kalin, 2009, p. 4) play a determinant role in attracting FDI. Third, internalization, which means that the MNCs will invest in a host country "if the gains are larger in doing so than reaching the foreign market through licensing or selling technology to local entrepreneurs" (Kalin, 2009, p. 4).

From the host country's standpoint, the inflow of FDIs is expected to bring positive spillovers through direct employment generation, raising total factor productivity through technology transfer, and backward linkages to local suppliers. The host country hopes that these advantages will contribute to narrowing the technological gap with the investor country while increasing local economic activity and, thus, stimulating economic growth. However, despite some compelling evidence, economists such as Paul Krugman (1983) have argued that foreign investments account for only a fraction of capital formation. Consequently, FDI can hardly be considered an important driver of economic growth in a host country. Moreover, studies have shown that FDI and economic growth have a quadratic relationship (with a graph showing a concave form and a maximum which is the threshold) and that when the size of the FDI is small in relation to the host economy, it has a strong accelerating growth effect. However, once the size of the FDI crosses a certain threshold, its growth effect dissipates to yield a negative impact on the recipient country's economy (Weijun et al. 2020).

B. The Role of Human Capital and Its Absorptive Capacity

Researchers have identified knowledge spillover as one of the primary channels of the impact of FDI. Moreover, the formal training of employees is one of the ways the technology transfer occurs. The MNCs "tend to invest in the training of the local workforce, … an effect that can spill over to other sectors in the economy and last for a relatively long time" (Kalin, 2009, p. 6). Consequently, it is crucial that the MNC agrees to transfer its "technological know-how, marketing skills, and international experience to the host country firms" (Kalin, 2009, p. 6). However, the technology transfer will not occur if the level of human capital in the recipient country is below a certain threshold. According to Hyman (2012), "not all FDI are created equal" (p. 11). If the technological gap is too great in high growth and high value-added technology sectors, the transfer of know-how will not occur and the impact of FDI on the larger economy will be muted at best and negative at worst. Furthermore, "companies endowed with cognitive capacities that allow the internalization of knowledge brought by a multinational or organization tend to increase productivity when exposed to new techniques, procedures, and technologies" (Moralles et al., 2020, p. 260). Moralles et al. (2020) further argued that in addition to the high level of absorptive capacity, productivity spillovers tend to be more efficient when the recipient country is located near the source of knowledge. They argued that the significance and sign of the spillover effects depend on the geographical proximity or vary with the level of foreign presence within a company cluster (Moralles et al., 2020). Hence, the impact of FDI on economic growth depends on many factors: the absorptive capacity of the stock of human capital of the host country, the size of FDI relative to the local economy, and the geographical proximity of the source of know-how. Since Colombia has met these requirements, its economy has been able to benefit from the inflow of FDI.

C. The Openness Policies and the New Legal Framework to Channel Foreign Direct Investment

FDI is dependent on an open economy, and it is at once a product and an instrument of economic globalization. An open economy is a sine qua non for FDI existence. Similar to most countries, Colombia reversed its hostile policies toward FDI, which were characterized by import substitution and industrialization policies in 1991 and reformed its constitution in favor of new export-oriented economic policies that aimed at improving the country's competitiveness in the global FDI market. The new policies were a "deliberate effort to attract export-oriented FDI to the region … with simultaneous goals of boosting growth and increasing local firms' competitiveness via long-run learning spillovers to local firms" (Hyman, 2012, p.12). According to Kalin (2009), FDI investment in Colombia has begun its third phase with an emphasis on attracting high value-added investments. Moreover, FDI is now permitted in almost every sector of the Colombian economy without preapproval with the exclusion of financial services, hydrocarbons and mining, and the defense and national security sectors, which are considered strategic. New legislations have established three main principles that govern the FDI regime in Colombia: equality (no discriminatory or preferential treatment over domestic approval), automatic approval for investments, and universality (all sectors are open to foreign investment with some exceptions). Kalin (2009) has stated that the new incentive framework includes legal stability contracts (LSCs), free trade zones (FTZs), and fiscal incentives in service export activities, along with the creation of some strategic sectors. Moreover, he explained that to protect investors from adverse impacts due to changes in national legislation, LSCs were enacted in 2005. The only requirement for benefiting from the legal coverage that the LSCs provide is that FDI must exceed US$1.49 million, and "1 per cent of the investment … [must be] paid to the government as a premium" (Kalin, 2009, p.14).

The FDI literature acknowledges the importance of an open economy because it is an essential characteristic of a modern economy to enable the free flow of goods, services, capital, and know-how.

Colombia is a member of many free trade agreements and most notably the Trade Promotion Agreement with the US, the European Free Trade Association with the European Union, the Pacific Alliance with other Latin American countries, and most significantly the World Trade Organization which is a global institution that facilitates and regulates international trade between countries. Additionally, Kalin (2009) noted that the business climate has improved considerably because complex rules for establishing new businesses and complicated legal frameworks have been removed. As a result, "the World Bank ranked Colombia among the world's most successful business climate reformers in its Doing Business Report 2009" (Kalin, 2009, p. 23). However, to facilitate trade and to attract FDI in regions where investment is the most needed, Colombia needs infrastructure investments. The terrible quality of the roads constitutes an obstacle to inland investments. Moreover, transportation costs are high, and "roads are inadequate and since most of the industry is concentrated in the interior of the country, transportation to the coast for exportation is costly and time-consuming" (Kalin, 2009, p. 20). However, Colombia has access to many shipping ports, among these are the port of Barranquilla, the port of Cartagena, the port of Santa Marta, the port of Tumaco, and the port of Buenaventura, which, according to i.Containers (2021), represent the top five shipping ports in the Latin American continent. It should also be noted that according to the Colombia Central Bank, most of the FDIs that Colombia has received in the past 30 years have been in Bogota and Medellin, the two main cities. Consequently, these two metropolitan cities have seen massive economic transformation that has led to increased employment and labor productivity, growth in university enrollments, increases in capital formation and business creation, and the creation and expansion of the IT sector with high added value, which has resonated throughout the rest of the Colombian economy.

II. **The Impact of Foreign Direct Investment on the Two Major Cities of the Andean Region: Bogota and Medellin**

A. Sectorial and regional distribution of Foreign Direct Investment

According to the UNCTAD's (2020) World Investment Report, FDI inflow to Colombia rose to US$14.5 billion in 2019 from US$11.5 billion in 2018, and the number of greenfield investment projects increased from 112 in 2017 to 224 in 2019, with total values of US$3.09 and US$6.8 billion dollars, respectively. Colombia nonetheless remained dependent on extractive industries such as mining and energy projects (oil and gas). Furthermore, Invest In Colombia, a government investment portal dedicated to providing information to potential investors on opportunities for investments in Colombia, estimated that in 2019, 32% of the FDIs were in the oil and mining sectors, whereas 21% were in financial and professional services, with the manufacturing sector receiving only 11% of the FDI inflow. Bogota, the capital city, and Medellin are both in the Andean region and along with other cities in the Caribbean regions are home to more than 70% of the industrial establishments in Colombia, according to Balat et al. (2018). Moreover, in 2019, Bogota received an estimated US$3.9 billion or 28.6% of the FDI inflow into Colombia, whereas Medellin received US$1.09 billion or 8.1% according to the National Administrative Department of Statistics (DANE). The capital city has received the lion's share of the FDI in the country for over a decade, receiving US$16.77 billion in FDI primarily in financial services and communications, which has propelled Bogota into one of South America's most dynamic and important business centers according to the government's investment portal (Invest in Colombia, 2020). This massive inflow of investment has positively impacted not only Bogota city but also other Andean cities and most notably Medellin. The effects of these investments have reverberated across many dimensions, especially through increased levels of employment, increased demand for tertiary education, new enterprise creation, and increased levels of productivity.

B. Human Capital and Skills Development: University Enrollments, Graduates and Programs

    1. University Enrollments and Graduates

Tertiary education in Colombia is "a cultural public service, [that] is inherent to the social ends of the state", according to (Brunner et al. 2016, p. 61). Moreover, the institutions of higher learning are regulated by Law 749 of 2002 and Law 30 of 1992, which established four types of tertiary institutions: universities, which offer undergraduate and graduate levels of education and engage in scientific and technological research; university institutions, which develop programs that enable further specialization leading to a specific career; technological institutions, which offer programs that lead to higher levels of knowledge and skills in that area; and professional and technical institutions, which create professional and technical level training for a particular job or career. Data published by the OECD and the Colombia Ministry of National Education have shown there were significant increases in the number of tertiary institutions in Colombia from 2000 to 2021 and a continuous increase in tertiary student enrollments (Table 7). Moreover, average annual total expenditures on education as a percentage of Colombia's total GDP from 2000 to 2011 rose to 7.7% (own calculation from OECD data). In addition, data published by the QS World University Rankings in 2021 indicated that two of Colombia's leading universities are listed in the World Top 20, one of which is in Bogota city. Furthermore, the country has four universities listed in the "Top 20" universities in Latin America.

University enrollments have increased steadily in Bogota city and in the Antioquia region, whose main city is Medellin. Moreover, data obtained from the National Education Information System (SNIES) estimates that 771,313 students enrolled in tertiary level education in Bogota in 2019 compared to 516,771 students in 2010, which represents a 49.3% increase over almost a decade. In addition, Medellin and the surrounding metropolitan areas have maintained an average of 33.05% of Colombia's total tertiary enrollments and registered an increase of 33.97 % over the same period (Figures 6a & b). Moreover, data gathered from the OECD database indicates that the average percentage of Bogota's

total enrollment in tertiary education hovers around 63.9% for the period 2002–2010. In addition, despite a high dropout rate, the total number of graduates from all the tertiary levels of education in the capital city increased from 88,299 in 2010 to 175,844 in 2019, and Medellin registered an increase in graduates from 41,792 in 2010 to 90,911 in 2019, which are increases of 99.2% and 117.5%, respectively (author's own calculation). Furthermore, due to economic growth in the last 20 years, an increasing number of Colombians citizens can afford to study abroad. According to the World Education Services (WES), the number of tertiary students studying abroad increased by 140% between 2002 and 2018, from approximately 1 million to 2.4 million students. Moreover, WES indicated that despite the precarious situation of Colombia's financial state, the country's middle class increased from approximately 11% of the population in 2001 to nearly 30% in 2014.

2. **Programs Offered and the Demand in the IT Sector**

Data retrieved from the SNIES database indicate that in both cities the programs for which there is increasing demand are engineering, administration, economics, architecture, and urban planning (Figures 6a & b). Furthermore, WES revealed that between 2001 and 2010, the number of higher education programs offered in Colombia increased from 3,600 to 6,276. The country has also invested heavily in the IT sectors, and according to the "Invest In Colombia" portal, Bogota is the epicenter of IT technology in the country. Bogota is the fourth largest IT market in Latin America after Brazil, Mexico, and Argentina. This sector "is one of the most dynamics industries in the Colombian economy, with an annual average growth of 14% in the last 10 years" (Invest in Bogota, 2020, P. 1). Furthermore, data published by the government shows that IT exports have increased at an average annual growth rate of 8% in the last 7 years reaching US$211 million in 2017 up from $US122 million in 2010. Domestic demand for IT services from the industries operating in many sectors of the economy also exceeded US$8.2 billion in 2019. In addition, to support this new sector, the number of graduates in computing

systems engineering and related fields also registered an average annual growth rate of 6% from 12,200 in 2007 to 22,200 in 2017, with Bogota and Medellin producing 38% and 14% of the total graduates, respectively. Overall, the number of students graduating from IT-related fields reached a staggering 690,491 over the period 2001-2018 according to "Invest In Colombia" (2020). Scholarships are also available for students who wish to pursue IT-related careers, which help to provide available skills and to sustain growth in the IT sector. According to "Invest In Bogota," Colombia is the third largest labor force in South America with an estimated 26.4 million people, and Bogota, as the main creator of talent in Colombia, constitutes more than 25% of the country's labor force. Moreover, "Bogota stands out as the country's main education cluster, with 38% of graduates in careers of interest" (Invest in Bogota, 2020). As a result of the large and educated workforce and education cluster, many foreign MNCs have established a presence in Bogota. Companies such as Google, IBM, GLOBAN, UNISYS, TATA Consultancy services, and many others have invested heavily in Bogota city. In addition, to incentivize the MNCs presence in Colombia, the government created FTZ regimes, labor incentives, VAT exemptions and export benefits, and R&D incentives. According to the government investment portal (Invest In Colombia), the country offers excellent international connectivity by means of fast data transmission and stability with 11 submarine cables in operation, which mean Colombia has the second highest number of cables in the region. Moreover, data published by the Ministry of Information Technology and displayed on the government investment portal shows that Colombia registered 32.7 million broadband connections in 2018, which represents an increase of 1067.9% from 2.8 million broadband connections in 2010.

Colombia has a strong business process outsourcing (BPO) industry, and it is regionally and internationally recognized in this sector. BPO is a business practice that enables companies located in developed countries to reduce labor costs by subcontracting part of their business to external service providers located in less developed countries. With its increasingly educated and experienced business-savvy workforce, Colombia provides back office and front office BPO services in areas such as contact

centers, collection, auditing, marketing, and technological support, and consulting. According to the government investment portal, Colombia has captured 13.1% of the BPO sales in the Latin American region, which places it ahead of Argentina, Peru, and Chile. Furthermore, the National Administrative Department of Statistics indicates that exports from the BPO sector increased 9.6% in 2019 to reach US$1.17 billion. According to the government investment portal, this growing sector is one of the highest job generators in the Colombian economy comprising more than 583,000 employees, with most services provided to the US and Spain.

Despite the high levels of inequality that exist at all levels of Colombians society, the lower-class have continued to gain access to tertiary education, which has enabled them to move to the middle class, according to the OECD data. In addition, as the data reveals, the absorption rate of Colombian students into higher education institutions represented by the ratio of admitted students to the number of applicants, rose to 55% in 2010. Therefore, the continued growth in demand for tertiary education is likely to remain strong for the foreseeable future, and this growth will play an important role in building the country's stock of human capital necessary for continued economic growth. However, the increasing number of students who are seeking a foreign education is a cause for concern since skilled labor tends to flow and aggregate where it possesses the most value. This situation is a double-edged sword because it could result in brain drain from Colombia toward more advanced Western countries at the time when the country most needs this labor.

C. Level of Employment, Industries, and Total Factor Productivity

1. Level of Employment and Labor Productivity

The Colombian economy grew at an annual average rate of 3.5% during the period 1990–2019, and the GDP per capita in current U.S. value reached its highest value of US$8,218.3 in 2013 from a low of US$1,445.3 in 1990 before settling at US$6,428.7 in 2019, according to DANE. During this period of relative economic expansion, the monthly employment level as a percentage of the labor force in the 13

largest metropolitan cities maintained an average of 57% and the unemployment rate hovered at 12.8%

(Colombia Central Bank). However, the picture differed significantly for Bogota and Medellin, the

number one and two cities in Colombia, respectively. Using the 2015 value of the exchange rate for the

Colombian peso to the U.S. dollar, the per capita GDP for Bogota city grew from US$4,882 in 2005 to

US$13,158 in 2019, while Medellin's per capita GDP grew from US$3,407 to US$8,540 during the same

period. Moreover, the city of Bogota maintained an average GDP growth rate of 3.5% during the period

1990–2019 and its share of the Colombian GDP hovered around 26.1% for the same period with a brief

peak at 28% in 1998 (DANE). Conversely, Medellin maintained an average growth rate of 3.2% between

1990 and 2019; its average share of the Colombian GDP was approximately 15% over the same period.

The economic growth generated by the influx of large amounts of FDI capital in Bogota and Medellin

has enabled the labor market to improve significantly in those cities. Bogota maintained an

unemployment rate below the national average of 12.2% between 1995 and 2016 and Medellin

maintained an unemployment rate of 10.3% for the 2010–2019 period, according to DANE.

2. Foreign Direct Investment and Domestic Industries

The effects of FDIs in both regions have been significant, with Bogota and Medellin as the

primary and secondary destinations, respectively. In 2004, Bogota received US$1.56 billion in FDIs from

a total investment stock of US$1.7 billion for the year in Colombia, which constituted 91% of the total

FDI stock awarded to Colombia, whereas Medellin only received US $52.8 million during the same year.

Moreover, the following year the total amount of FDI awarded to Colombia increased to US$3.73 billion

and the capital city saw its share climb to US$3.2 billion, which represents an increase of 107% (yoy).

Similarly, the share of FDI awarded to Medellin rose to US$240.1 million in 2005, which is a 354.8%

increase over the previous year. Furthermore, the geographical location and concentration of FDIs are

worth noting, as stated by Betancourt (2012), "During 2009 and the first quarter of 2010, the capital of

Colombia, Bogota D.C., and the region of Cundinamarca, in which Bogota is located, captured 78% of the total flow of FDI, followed by Antioquia (8%) [the department in which Medellin is located] …" (P. 3). This percentage represents a reduction compared to the 2004 figure when Bogota and the region of Cundinamarca received 91% of the total FDI inflow. The improvement in the repartitioning of the regional distribution of FDI was due to the development of the absorptive capacity of the other regions, such as the greater availability of human capital and the removal of impediments to business creation, according to Betancourt (2012). Moreover, the oil sector and the manufacturing industries were the two largest recipients of FDI, with mining and financial services following closely between 1996 to 2019, according to DANE (Figure 7).

Bogota is the largest economic center in Colombia, and it is the home of most domestic corporations. The city generated US$94 billion in GDP in 2014 (U.S. Department of Commerce, 2021) and harbors 70 shopping centers, one of which is the largest in the country and the second largest in Latin America. Bogota is the second most important export region in Colombia after Antioquia, whose capital city is Medellin, and its importations reached US$27.34 billion, accounting for 53% of Colombia's total importations, according to the U.S. Department. of Commerce. Moreover, Bogota is the main air cargo hub in Latin America and received 670,222 tons of cargo in 2015, which represented 67.95% of the total air cargo arriving in or transiting through the country. Furthermore, the city has the third largest passenger terminal transporting more than 29,956,551 passengers in 2015, according to the U.S. Commerce Department. It is the most important center for foreign trade in Colombia and accounts for 30.4% of the total import/export in the country. The capital city is home to 33% of Colombia's enterprises, whose number is estimated at 384,000 companies. Moreover, it is also the home of 1,500 foreign companies such as 3M, PEPSICO, Pfizer Inc., Danone, SABMiller, Siemens, and TATA Motors, among others (U.S. Dept of Commerce, 2021).

The Bogota region contains four FTZs and 50 industrial parks to help attract foreign investments. Moreover, according to the U.S. Department of Commerce, companies operating in the special zone receive preferential income tax treatment calculated at 15%. Additionally, they benefit from a duty-free importation regime with the ability to purchase raw materials exempt from all VAT, along with the opportunity to sell in the Colombian market. In contrast, Medellin and its surrounding regions received more than US$2.7 billion in foreign investments between 2008 and 2020, representing a total of 258 projects from more than 35 countries. Moreover, six of the nine Colombian companies that feature in the multilatinas index score are headquartered in the city according to the "Invest In Medellin" portal. Both cities are home to clusters of companies, which are essential for knowledge spillovers within and across the sectors of the economies of those cities and Colombia. Moreover, the proximity and the proliferation of many enterprises facilitate backward and forward linkages between potential suppliers and the MNCs operating in those metropolitan cities.

3. Total Factor Productivity

Despite the rise of output per worker between 2007 and 2013 and the increase in GDP per capita, the productivity of capital and labor and by extension the TFP of the Colombian economy has not followed a specific trend and has not reflected the level of FDI influx into the economy. However, examining the secondary and tertiary sectors of Bogota and Medellin's economic activities reveals the impact of the inflow of FDIs in these regions (Figures 5a&b). In both regions, the tertiary and secondary sectors have grown significantly. In Bogota, the tertiary sector grew from US$2.2 billion in 1990 to US$101.5 billion in 2019, while Medellin's tertiary sector grew from US$1.04 to US$45.13 billion during the same period (using the 2000 exchange rate). Moreover, the same calculation for the secondary sectors of both cities and for the same period reveals that Bogota's secondary sector grew from US$450 million to US$15.3 billion, while Medellin's grew from US$630 million to US$15.88 billion. The results

reveal that the tertiary sector in Bogota grew by a staggering 3,300% and that Medellin's tertiary sector registered a growth of 2,420.6% (author's own calculation). This impressive economic growth could not have been achieved without a massive influx of foreign investment and a readily available stock of human capital (Figure 8). All economic growth theories recognize investment as an indispensable factor for economic growth. Yet, Colombia, in the last decade of the 20th century and at the turn of the new millennium did not dispose of significant domestic savings to support its investments. Therefore, it is fair to state that FDI(s) have been paramount in Colombia's impressive economic achievements in the last 30 years.

D. Privatization, Business Formation, and Spillover Effects

1. Privatization of Colombian Mixed Enterprises and State-Owned Enterprises, and the Flow of Foreign Direct Investment

Enterprise creation is an important factor in the economic development of a country, and its sustained economic growth depends on entrepreneurship and continuous innovation. Moreover, a country's ability to promote entrepreneurial activities is directly linked to the development level of its financial system, which serves as a conduit to channel domestic and foreign savings. Well-planned monetary policies supported by good government policies can promote the accumulation of household and corporate savings to support domestic investments. Furthermore, a well-developed financial market enables a country to efficiently allocate savings by financing profitable projects and companies and drive inefficient companies out of business. In the 1990s, Colombia did not have sufficient domestic savings to power its economic development in any sustainable way, and it had great difficulties accessing foreign credit markets for the obvious reasons of internal political strife, a state of virtual civil war, and narco-fueled violence. This situation placed Colombia in a state of low economic growth that also affected

other Latin American countries. According to Aizenman (2005), Latin American countries had insufficient growth rates and, hence, low self-financing abilities. To attract foreign capital, Colombia began to liberalize its economy and privatize its state-owned enterprises and mixed enterprises. Moreover, "economic deregulation in Colombia was part of a comprehensive long-term strategy to promote new roles for the public and private sectors" (Chong et al. 2003, p. 275). In addition, according to Chong et al. (2003), the authorities in Colombia approached privatization as a tool to promote economic deregulation, foster market competition, and create incentives to channel private investments into supporting public infrastructure and network industries.

Most of the privatized enterprises operated in the Bogota and Santander regions. The former is the capital city, which constitutes the main industrial center of Colombia, and the latter is the area with the highest concentration of petroleum extraction and refinery activities. Privatization occurred in many sectors of the Colombian economy – most notably in manufacturing, services, telecommunications, mining, electricity, and the natural gas sector. In the manufacturing sector, for instance, the Instituto de Fomento Industrial, which was created in 1940 to promote industrialization in Colombia, proceeded to sell the shares accumulated over the years in its investment portfolio to private investors. According to Chong et al. (2003), the asset sales gave rise to the largest private capital enterprises in the steel, chemical, paper, fertilizer, metal working, and automobile sectors today.

Prior to the 1990s, Colombia was not seen as the best destination for FDI compared to its neighbors, Venezuela and Peru, which were considered better destinations for Andean operations, according to Betancourt (2012). However, the influx of FDI in the 1990–2000 decade was "a consequence of privatizations rather than market-led opportunities for new projects" (Betancourt, 2012, p. 2). Moreover, in the late 1990s, the Colombian economic crisis appears to have initiated the flow of inward FDI beginning with the receipt of US$1.5 billion in 1999 and subsequent flows that amounted to 3% of the GDP in 2000, culminating in US$10.3 billion worth of FDI inflow in 2005, according to Betancourt (2012).

2. Business and Capital Formation

Data published by DANE in 2017 indicated that the number of new businesses created in Colombia grew from 29,118 in 2006 to 55,679 in 2014, which represented an increase of 91.2% over the 2006 figure. Moreover, nearly half of the newly created enterprises were in Bogota, of which more than 90% were microenterprises, according to Cao-Alvira et al. (2021). In Bogota, a sample of 320,600 small businesses was surveyed in 2012. The survey revealed that 53.3% of the businesses were in the commerce sector, 37.3% were in the service sector, and 9.4% were in the industrial sector. In Medellin city, a sample of 111,400 small businesses were surveyed, of which 56.9% were in the commerce sector, 33.2% were in the service sector, and 9.9% were in the industrial sector. Furthermore, a small business survey conducted and published by DANE in 2015 indicated that the number of small businesses with less than 10 employees had reached 4.7 million and operated in almost all sectors of the economy: manufacturing, communication, transport, commerce, construction, healthcare, and others. Furthermore, data from the Colombian central bank revealed that the gross monthly balance of outstanding loans to the private sector increased to US$6.7 billion in December 2020 from US$150.4 million in December 1993 (using the 2015 exchange rate of 2,741.88 pesos to 1 US dollar). The growth in business formation and the accumulation of domestic credit were significant over the 27-year period (1993–2020), and this growth can only be explained by the inflow of foreign capital that has revitalized the Colombian economy. The availability of greater domestic savings and the continued inflow of FDIs have contributed to the formation and accumulation of the necessary real gross fixed capital in the Colombian economy. Consequently, the sustained accumulation of fixed capital has helped Colombia to further generate income, thus, initiating an ongoing cycle until the economy reaches a steady state level.

3. Spillover Effects and Industry Linkages Generated by Foreign Direct Investment in the Colombian Economy

Previous FDI studies have shown the difficulties that exist in measuring intra-industry spillover effects. Economists have argued that foreign companies are careful to avoid competition with local companies in their sectors of operation. Therefore, MNCs perform due diligence with regard to the location choices of their subsidiaries, and they introduce technologies and processes that local companies will have no opportunity to reverse engineer. For these reasons, inter-industry spillover effects are the most commonly and easily measured. According to Kugler (2006), knowledge spillover occurs when companies use advanced production technology, processes, managerial knowledge, and working practices that have been developed by other companies, and the recipient firms may be business partners, competitor companies, and even enterprises operating in entirely different sectors. Accordingly, I argue that the forward and backward linkages generated between the industry sectors that are recipients of FDI have added value to the commodities extracted by the companies in the primary sector and allowed the Colombian economy to capture the added value by processing and refining these resources. In addition, it is also reasonable to state that the chain reaction of the industry linkages caused an explosion of entrepreneurship and instigated an economic domino effect, which did not exist in the Colombian economy prior to the 1990s.

In 2005, according to Betancourt (2012), Colombia received its largest FDI inflow to date with the acquisition by SAB Miller of the UK of a 78.1% stake in Colombia's largest brewery (Bavaria), which was worth approximately US$10.3 billion. Furthermore, data compiled by Betancourt (2012) shows that between 2008 and 2010, Colombia received 35 FDIs in the form of M&A which amounted to US$5.7 billion. In addition, during the same two-year period, the country received 30 greenfield projects totaling US$13.8 billion. These M&A and greenfield investment projects occurred in almost all economic sectors from financial, manufacturing, mining, oil and gas to department stores and food and beverages. Additionally, "of the ten largest non-financial companies in Colombia, six are foreign affiliates of multinational enterprises, providing goods and services in different economic sectors … and playing an important role in the Colombian economy" (Betancourt, 2012, p. 4). Moreover, data accumulated from

the Banco de Colombia database (the Colombian central bank) shows that the largest foreign financial institutions in Colombia operate in the banking and pension fund industries, with local institutions in control of the sector, whereas the MNCs take the lead in the non-financial sector, according to Betancourt (2012). In the financial sectors, a number of notable North American and U.K. institutions such as Citibank, HSBC, and J.P. Morgan can be found.

The influx of FDI into almost every economic sector in Colombia has created opportunities for spillover effects. With the turnover movement in the labor market, individuals with prior MNC experience who have received training in new managerial processes and exposure to more advanced technologies have shared their newly acquired knowledge with their new coworkers in the local companies. Moreover, vertical linkages between local suppliers and manufacturers and the MNC subsidiaries have created positive productivity spillovers as a consequence of FDI externalities. The effect of the linkages can be observed in the expansion of the secondary sector and the exponential growth of the tertiary sector of the Colombian economy, both at the national level and at the metropolitan city level in Bogota and Medellin. Furthermore, FDI externalities can be observed in the increased demand for tertiary education since more job opportunities are available for those with higher education levels, which also offer better pay and benefits than the jobs available at lower education levels. Additionally, the accumulation of solid managerial skills either through working at an MNC affiliate or obtained through higher education have given rise to increased entrepreneurship, which has ultimately led to an explosion in business creation in the last 15 years. In addition, the growth in income per capita has enabled Colombian households to save more of their earned income, which is used to further enable capital formation to support the economic cycle all over again. If this process remains unimpeded, it will lead the Colombian economy to a steady state level.

With the advantages and the limitations of FDI in Colombia laid bare, an econometric analysis of the data enabled further clarification of the extent of the impact of FDI on the Colombian economy

for the 1990–2019 period. Moreover, this study has been able to quantitatively determine the direction of the causality of FDI. The analysis has also illustrated the magnitude of the impact of FDI mediated by human capital and its most important component "tertiary education" on the gross domestic per capita growth of Colombia.

III. The Model Designs, Methods, and Data Sources

A. Initial Assumption and Identification Strategy

To perform the econometric analyses, I obtained the data from the World Development indicator, the Penn World Table (10), DANE, the Central Bank of Colombia, and the OECD data bases for the 1990–2020 period. Using longitudinal data, I constructed five multivariate time series models with GDP per capita as the outcome variable with FDI, human capital, and gross domestic savings as independent variables, along with a vector of control variables such as net trade, inflation rate, exchange rate, battle deaths, and remittance received from abroad, which have had idiosyncratic effects on the Colombian economy in the last three decades. Through the models, I investigated the long- and short-run relationships of the economic variables by estimating the vector autoregressive (VAR) model, Granger causality and cointegration and performed mediation analysis tests. I created the developed models with log-differenced and lag variables for possible unit root and cointegration effects. Moreover, since the models have variables that are cointegrated, I calculated the error correction terms (ECTs) through the short-run models, which represent the speed of the adjustment of any disequilibrium between the short-run (less than a year) and the long-run (one year period) effects. Since this study focuses only on the elasticity effect of the independent variables on the outcome variable, the use of log form satisfies that purpose. Hence, I developed and hypothesized the main models as follows:

a. Time Series: ARIMA (2,2,2) Models

I developed two VAR models distinguished by the inclusion of the variable "remittance." The assumption was that remittance received from abroad was a form of foreign capital inflow into the Colombian economy for which neither goods nor services were exchanged. The VAR models are as follows:

1. $lny_t = \beta_0 + \beta_1 lni_t + \beta_2 lnh_t + \beta_3 lnr_t + \beta_4 lns_t + \beta_5 lnd_t + \varepsilon$

2. $lny_t = \beta_0 + \beta_1 lni_t + \beta_2 lnh_t + \beta_3 lns_t + \beta_4 lnd_t + \varepsilon$

b. The Developed Models (I–IV)

i. Model I: Long run and short run

1. $lny_t = \beta_0 + \beta_1 lni_t + \beta_2 lnh_t + \beta_3 lnr_t + \beta_4 lns_t + \beta_5 lnd_t + \beta_6 lnn_t + \beta_7 lnf_t + \beta_8 lnx_t + \varepsilon$

2. $lny_t = \beta_0 + \beta_1 lni_t + \beta_2 lnh_t + \beta_3 lnr_t + \beta_4 lns_t + \beta_5 lnd_t + \beta_6 lnn_t + \beta_7 lnf_t + \beta_8 lnx_t + \beta_9 ECT_{t-1} + \varepsilon$

ii. Model II: Long run and short run

1. $lny_t = \beta_0 + \beta_1 lni_t + \beta_2 lnh_t + \beta_3 lns_t + \beta_4 lnd_t + \beta_5 lnn_t + \beta_6 lnf_t + \beta_7 lnx_t + \beta_8 lni_t * lnh_{t-1} + \varepsilon$

2. $lny_t = \beta_0 + \beta_1 lni_t + \beta_2 lnh_t + \beta_3 lns_t + \beta_4 lnd_t + \beta_5 lnn_t + \beta_6 lnf_t + \beta_7 lnx_t + \beta_8 lni_t * lnh_{t-1} + \beta_9 ECT_{t-1} + \varepsilon$

iii. Model III: Long Run and Short Run

1. $lny_t = \beta_0 + \beta_1 lni_t + \beta_2 lnh_t + \beta_3 lns_t + \beta_4 lnd_t + \beta_5 lnn_t + \beta_6 lnf_t + \beta_7 lnx_t + \varepsilon$

2. $lny_t = \beta_0 + \beta_1 lni_t + \beta_2 lnh_t + \beta_3 lns_t + \beta_4 lnd_t + \beta_5 lnn_t + \beta_6 lnf_t + \beta_7 lnx_t + \beta_8 ECT_{t-1} + \varepsilon$

iv. Model IV: Long Run and Short Run

1. $lny_t = \beta_0 + \beta_1 lni_t + \beta_2 lnh_t + \beta_3 lns_t + \beta_4 lnd_t + \beta_5 lnn_t + \beta_6 lnf_t + \beta_7 lnx_t + \beta_8 lnh_t * lny_{t-1} + \varepsilon$

2. $lny_t = \beta_0 + \beta_1 lni_t + \beta_2 lnh_t + \beta_3 lns_t + \beta_4 lnd_t + \beta_5 lnn_t + \beta_6 lnf_t + \beta_7 lnx_t + \beta_8 lnh_t * lny_{t-1} + \beta_9 ECT_{t-1} + \varepsilon,$

where

lny = the natural logarithm of the GDP per capita (constant, 2010)

lni = the natural logarithm of FDI (net inflow, BOP current US$)

lnh = the natural logarithm of the human capital index (based on average years of schooling)

lnn = the natural logarithm of the net trade in goods and services (BOP current US$)

lnf = the natural logarithm of the inflation rate, consumer prices (annual %)

lns = the natural logarithm of the gross domestic saving (% of GDP)

lnx = the natural logarithm of the exchange rate, national currency (market estimate)

lnd = the natural log of the number of battle-related deaths

lnr = the natural log of remittance (BOP receipts US$)

e = the natural logarithm of the tertiary level enrollment (yearly total)

ECT = error term from the corresponding long-run regressions

ε = stochastic error term

t = time in years (1990–2019)

The variables "net trade," "inflation rate," "gross domestic saving," "exchange rate," "remittance," and "battle deaths" were used as control variables to avoid confounding errors and endogeneity with omitted variables in the models. Moreover, the variable "net trade" was introduced as a measure of the degree of openness of Colombia's economy because the FDI literature stipulates that the impact of FDI is found to be greater in open economies.

B. **Specification of the Vector Autoregressive Models: Autocorrelation, Unit Root and Cointegration Tests**

a. **The Vector Autoregressive Models: Pre and Postestimation Tests**

I took the first level integrated differences for all the log-level variables in both VAR models to achieve stationarity; however, the "human capital" index required the second level to be differenced to reach stationarity. Moreover, I developed two VAR models with a maximum of two lags, and the postestimation test revealed that the models were stable. I also carried out Durbin-Watson tests for autocorrelation, and the results revealed that no autocorrelation existed in the models (the null hypothesis of no autocorrelation could not be rejected at all the significance levels (Table 3). Moreover, I performed the Augmented Dickey-Fuller test for the unit root as well as the Phillip-Perron test, and the null hypothesis was rejected at the 5% significance level for all the models and further confirmed the choice of two lag levels (Table 2 & Figures 1). Additionally, to avoid endogeneity and simultaneity bias, I performed the Ramsey test on all the developed models. The results showed that the null hypothesis of "no omitted variables" could not be rejected at the 5% significance level. Furthermore, the results of the Breusch-Pagan test for heteroskedasticity revealed that the models had constant variance and were normally distributed (Table 3). As a result of the preceding tests, all the developed models were error-free.

c. **Cointegration Tests and the Error Correction Model**

I carried out Johansen's multivariate cointegration test on all the models, and the results revealed that some of the variables were cointegrated in both VAR models (Table 1). Consequently, to resolve the cointegration issue in the models, I created the error correction models (ECMs) or the short-run relationship models among the variables. Hence, I obtained the ECTs for each developed model to measure the speed of adjustment of any disequilibrium between the short run and the long run in economic growth (Table 5). Furthermore, I evaluated an orthogonalized impulse-response function to determine the extent of the

duration of the shocks from FDI in the GDP per capita. The results suggested that for any one standard deviation positive shock in FDI, the GDP per capita increases slightly in the first period and then proceeds to decrease in the subsequent periods until finding support at a lower level.

IV. Regression Results and Discussion: Models I, II, III, and IV

a. Long-Run Results for Models (I–IV)

The long-run regression results in Table 4 show that the coefficients of FDI in all the developed models are statistically significant at the 5% level in Model I, and at the 10% significance level for Models II, III, and IV. Moreover, the positive signs of the current and prior FDI(s) highlight the critical role that FDI has played in the Colombian economy. This result suggests that FDI had a crowding-in effect on domestic investments and, consequently, enabled the accumulation of savings and fostered long-term economic growth in Colombia. Moreover, the larger positive signs and the statistical significance (at the 5% level) of domestic savings further confirm the positive and critical role of FDI. This effect is in line with the analysis of the impact of FDI on the Indonesian economy performed by Asafu et al. (2000) and also with most of the existing FDI literature. However, as time passes the effect of FDI on the Colombian economy becomes negative, which explains the negative sign for FDIs after 2 years. The negative sign implies that past inflows of FDI have reached maturity, and foreign investors are beginning to pull out their profits or even part of their original investment capital. This disinvestment places pressure on Colombia's balance of payment and leads to a negative current account balance and currency devaluation. I estimated the predictive increase in Colombia's GDP per capita using Model I and found that given the current level of FDI that Colombia is receiving, the GDP per capita is expected to increase at an average of 2.07% per year (Figure 2). Moreover, using the mean GDP per capita (US\$5,036.07) over the period 1970–2020 and applying the expected GDP growth rate, the value obtained (ΔY= US\$104.12) is close to the predicted increase (US\$120.9) in value given by the model (Table 9 & 10).

The human capital factor has also played an important role in Colombia's economic growth according to the results of the analysis in the long- and short-run models. The coefficients of human capital in all the developed models were statistically significant at the 5% level, which emphasizes the crucial role that this factor has played in attracting high value-added FDI into the Colombian economy. Moreover, the previous stock of human capital had a larger coefficient than FDI, which suggests that while foreign investment has been essential to Colombia's long-term economic growth, further investment in the accumulation of human capital will have a significantly positive impact on the Colombian economy (Figure 3). Additionally, as the Granger causality test results demonstrate, human capital and FDI were attracted to each other and jointly fostered the growth in GDP per capita. Consequently, Colombia has been able to build up its domestic savings (private and public) from the doldrum of the 1990s, which explains the highly significant effect (at the 1% level) of the gross domestic savings in the results. Hence, the availability of a sufficient level of human capital initiated FDIs by means of mutual attraction and jointly producing economic growth in Colombia (Figure 8). In addition, the economic growth generated adequate savings in the Colombian economy, which, along with new FDIs and increases in human capital, were used to create more growth initiating a recurring economic cycle.

b. Granger Causality and Mediation Analysis Test Results

The Granger causality test is a statistical and hypothesis test that is performed to determine whether one time series variable can be used to forecast the future behavior of another. Moreover, the test helps determine whether any causal relationship exists between the time series variables and provides the direction of the causality. Thus, I performed Granger causality tests on the following variables of interest: GDP per capita, FDI, and human capital. The analysis revealed that within a time frame of less than 6 years only FDI Granger caused GDP growth, whereas human capital alone, while being statistically significant, did not cause economic growth in Colombia. However, for periods of 6 years or longer, FDI and human capital jointly and individually caused economic growth in the Colombian economy (Table 8). The models explained the reality

of the Colombian economy at the beginning of the 1990s reasonably well. Colombia had a high level of human capital, and yet the economy was lacking investments due to insufficient domestic savings and the unwillingness of foreign investors to allocate their capital to Colombia. Consequently, economic growth was anemic or nonexistent. However, the privatization of public enterprises and the adoption of a new regulatory framework ushered in conditions suitable to attracting FDI. In the initial period, the availability of human capital was a necessary but not sufficient condition to cause economic growth because an economy needs investment to function adequately. However, it was necessary to attract high-level human capital with significant value-added FDI. Moreover, once Colombia's economic engine was activated with the influx of foreign capital, FDI, and human capital, Granger causality indicates each caused the other and, thus, the launch of the Colombian economy (Table 8). Additionally, the growth in GDP per capita shown in the test results preceded the rise in human capital. This result eventuates because as the economy prospers and more jobs opportunities arise at the tertiary level, more individuals will seek higher levels of education and skills to fill these jobs. The tests results (Table 8) show the difficulty that exists when performing the Granger causality test to determine the direction of a relationship because endogenous variables such as GDP per capita, FDI, and human capital appear to have a bidirectional causality among themselves. I believe that it is the case in this study. The pairs of variables exhibit a bidirectional causality, which can obfuscate and complicate the results of the analysis.

This study is the first to introduce a mediation analysis of human capital to measure the extent of FDI's impact on GDP per capita that is mediated through human capital. Moreover, this analysis is the first to decompose human capital to measure the level of mediation produced by tertiary enrollments as opposed to the human capital index (obtained from WDI), which is based on average years of schooling. The analysis has revealed that the human capital based on years of schooling mediated only 2% of the effect of FDI on GDP per capita growth. However, when considering only the tertiary level of the human capital index, the mediation rose to 25% (Table 6 & Figure 4). The mediation effects in both cases were partial; however, the mediation tests highlight the importance of the tertiary level of education since it channels more of the growth effect of FDI into the Colombian economy. Moreover, by extension, the analysis identifies tertiary

education as an important path to amplifying the impact of investments (foreign and domestic) in an economy. A skilled workforce is necessary for continued economic growth, and, in the case of Colombia, the tertiary level workforce has been paramount to its strategy to attract FDI and to sustain economic growth. The mediation analysis also helps to explain and justify the expansion of the demand for tertiary level education observed in Colombia since 2000. In addition, the analysis has revealed the path and the intensity of the impact of FDI on Colombia's economic growth. Thus, it is clear that without the inflow of FDI into the Colombian economy in the past three decades, the growth level that has been achieved in the economy would not have occurred.

Conclusion

This study has shown that the inflow of FDI into the Colombian economy for the past 30 years has been an important engine for economic growth, as its policymakers had expected. Moreover, FDI has created a crowding-in effect, according to Borensztein et al. (1998) since the influx of FDI stimulated domestic investments and created the conditions for capital formation and savings accumulation for more investments. Moreover, the crowding-in effect resulted from the complementarity that exists between the MNCs and the domestic companies operating within the same cluster of economic activities. The clustering also created the ideal conditions for backward and forward linkages between suppliers and MNCs and between MNCs and their local affiliates. This clustering of economic activities has enabled the Colombian economy to benefit from positive spillovers. However, the results of the analysis have also shown that while FDI has been significant and played a crucial role in the economic growth of Colombia, gross domestic savings appear to have played an even larger role since the coefficients for gross domestic savings were all statistically significant at the 1% level in all the long-run models. Additionally, they eclipsed those of FDI by a significant margin in the long-run as well as in most of the short-run models.

While most of the FDI investments occurred in the primary sector (agriculture, fishing, forestry, mining, quarrying, and petroleum), the contribution of FDI to Colombia's GDP growth has been significant.

Moreover, linkages between the primary and secondary sectors played an important role because most of the outputs of the primary sector, such as petroleum, oil derivatives, emerald, gold, food processing, and coffee, were processed and refined, and then either sold on local markets to meet domestic demands (the agro-industrial products, for instance) or exported to the U.S. and EU markets. Consequently, the Colombian economy benefited from the added value generated by its manufacturing sector. Moreover, a further linkage was created between the manufacturing sector and the service sector through the clustering of business activities because new businesses were established to meet the demands of the factory workers (transport, utilities, banking, restaurants, communication etc.), and cities such as Bogota D.C. and Medellin benefited tremendously in this way. In addition, solving the political crisis and the reduction in violence has enabled the country to profit from an increasing tourism industry, which has further supported the service sector and brought foreign currencies into the Colombian economy.

FDI has been the catalyst that set the process of Colombian economic growth into motion. This catalyst had two effects: at one level, it provided the necessary capital infusion to jumpstart the economic engine, which was suffering from a lack of investments due to low levels of domestic savings and the aversion of foreign investors to the excessive investment risk that Colombia constituted. On the other level, the process of privatization that began in the early 1990s signaled to potential foreign investors that the authorities were serious about developing the Colombian economy. Moreover, the process of economic liberalization through market and regulatory reforms generally boosted the confidence of the transnational investment community that Colombia was open for business.

Nonetheless, although FDI was the catalyst that jumpstarted the Colombian economic engine toward growth, it would not have occurred to the extent it has without the availability of an adequate level of human capital. Moreover, the transfer of know-how from the MNCs to suppliers and their local affiliates, as well as the positive spillover effect onto other domestic companies, requires the existence of a highly skilled workforce. According to Moralles et al. (2020), low "absorptive capacity" triggered by "insufficient cognitive capital" causes a negative spillover effect in the economy. The current FDI literature reveals the conditioning role of human capital in the FDI-GDP growth relationship and emphasizes the absorptive capacity of the

host countries as a necessary condition for FDI to foster economic growth. Moreover, the results of this analysis have shown that human capital has played a critical role in not only attracting FDI but also acted individually and jointly with FDI to produce economic growth in Colombia. In addition, the tertiary level of education as a component of human capital has played a significant role in mediating the effects of FDI on economic growth. Human capital preceded FDI, with both Granger causing the other and acting individually as well as jointly to Granger cause economic growth in Colombia.

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Graphs and Tables

Figure 1

Stationarity Test Results

Stationarity Test Results

Figure 2

Expected Impact of an increase in FDI on GDP per capita
Predictive margins with 95% CIs
Predictive margin of GDP per capita given model I (ΔY= 0.020665)

Figure 3

Expected rise in GDP per capita per increase in Tertiary Enrollment

Predictive margins with 95% CIs

Predictive margin in GDP given model I (ΔY = 0.020665)
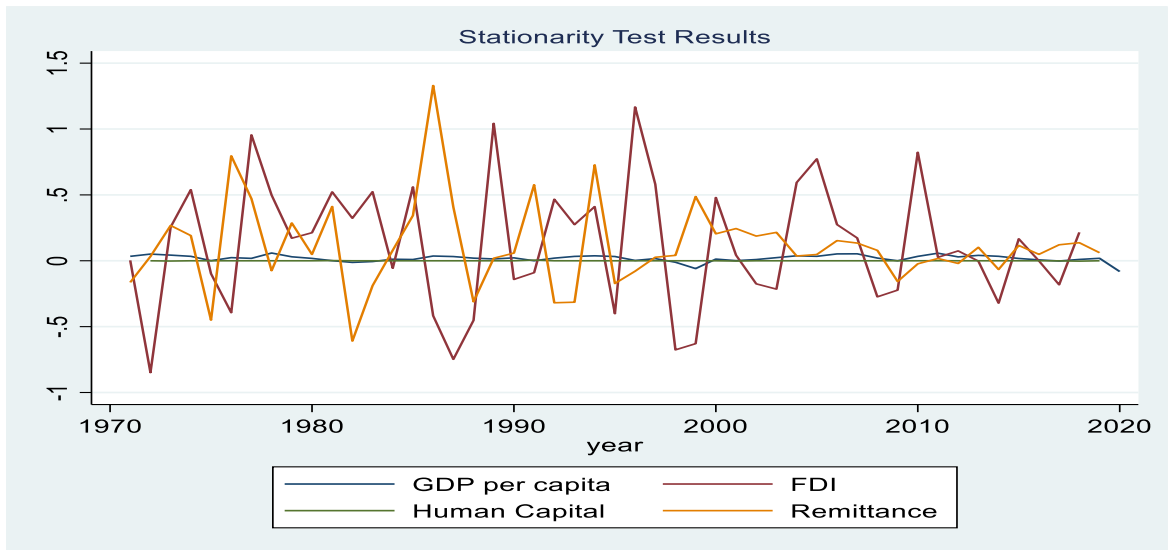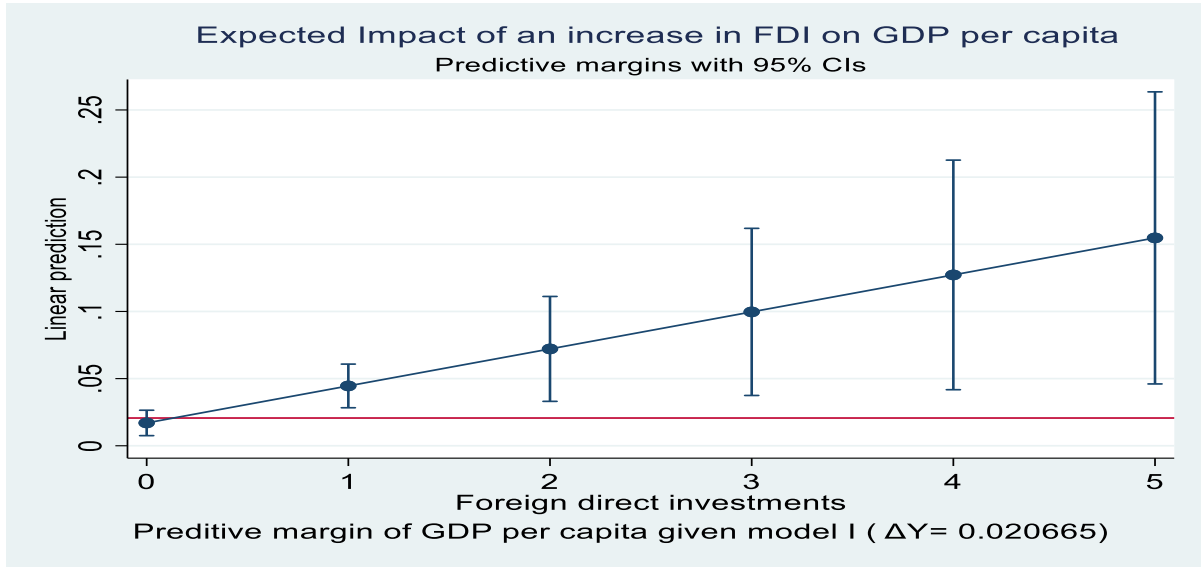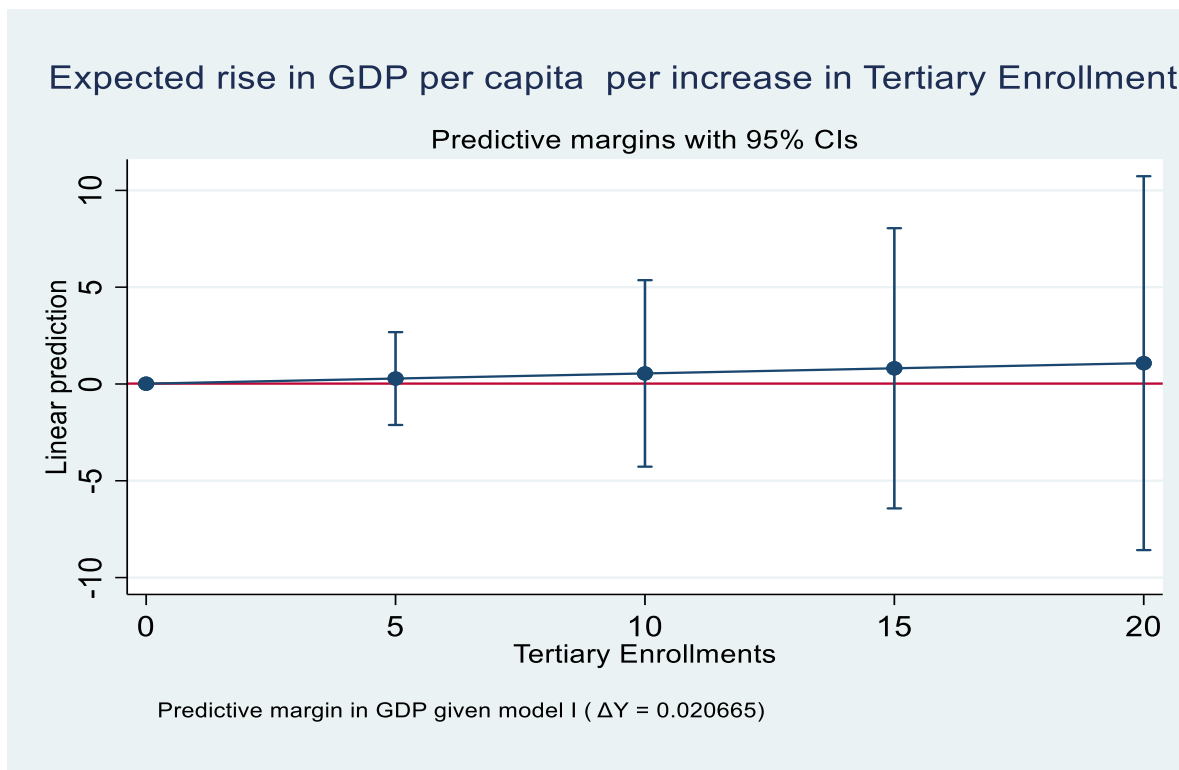
Figure 4

SEM: Structural Equation Modeling

a) With Human Capital:
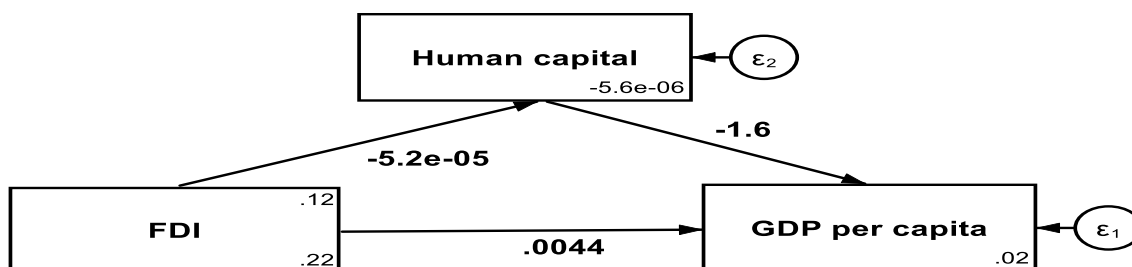
*SEM Path: (GDP per capita <- Human capital FDI) (Human capital <- FDI)

**Meaning that about 2% of the effect of FDI on GDP per capita is mediated by human capital!

b) With Tertiary Enrollment:
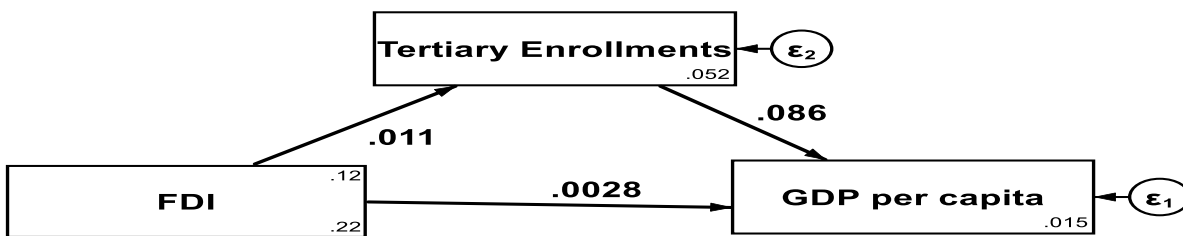
* **SEM Path:** (GDP per capita <- tertiary enrollments, FDI) (tertiary enrollments <- FDI)

*Meaning that about 25% of the effect of FDI on GDP per capita is mediated by tertiary enrollments!

Figure 5

a)

b)

Sector Economic Activity Growth
(U.S. base 2015 exch. rate)

Figure 6

a)

Bogota: Enrollment by Level of Training
2010-2019

b)

Figure 7

Figure 8

FDI impact on GDP per capita & Human Capital
Colombia (1970-2020)

Table 1:
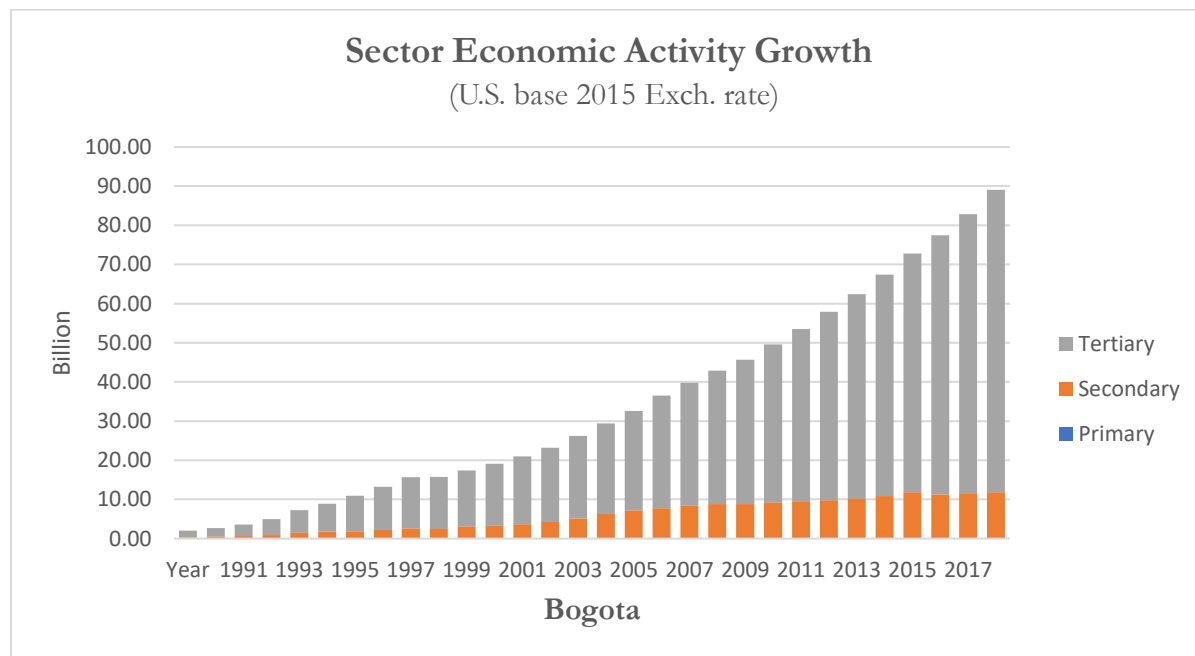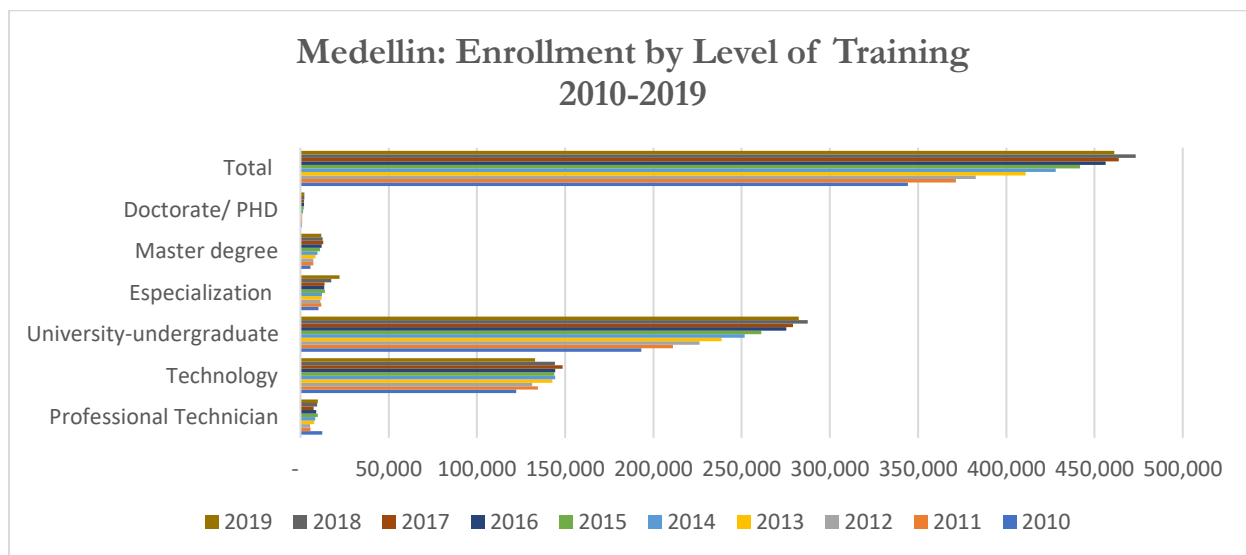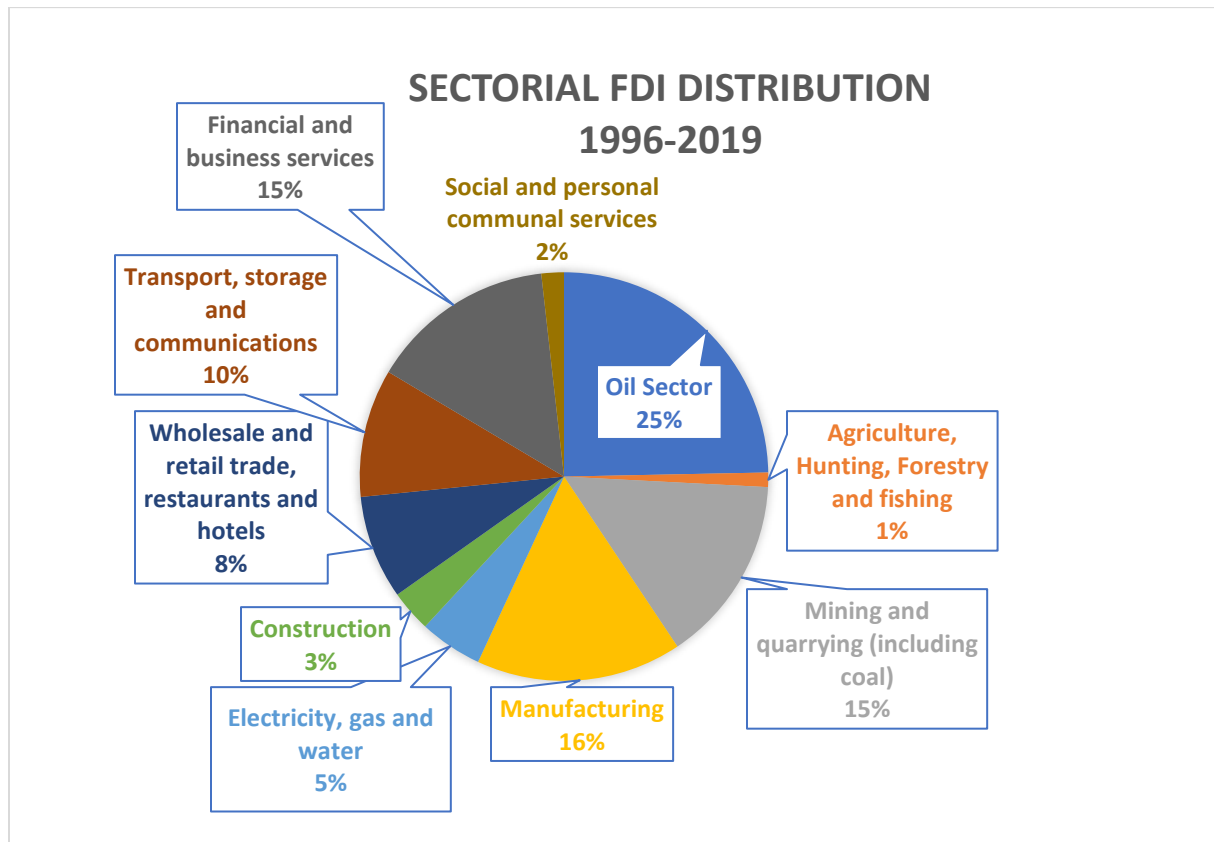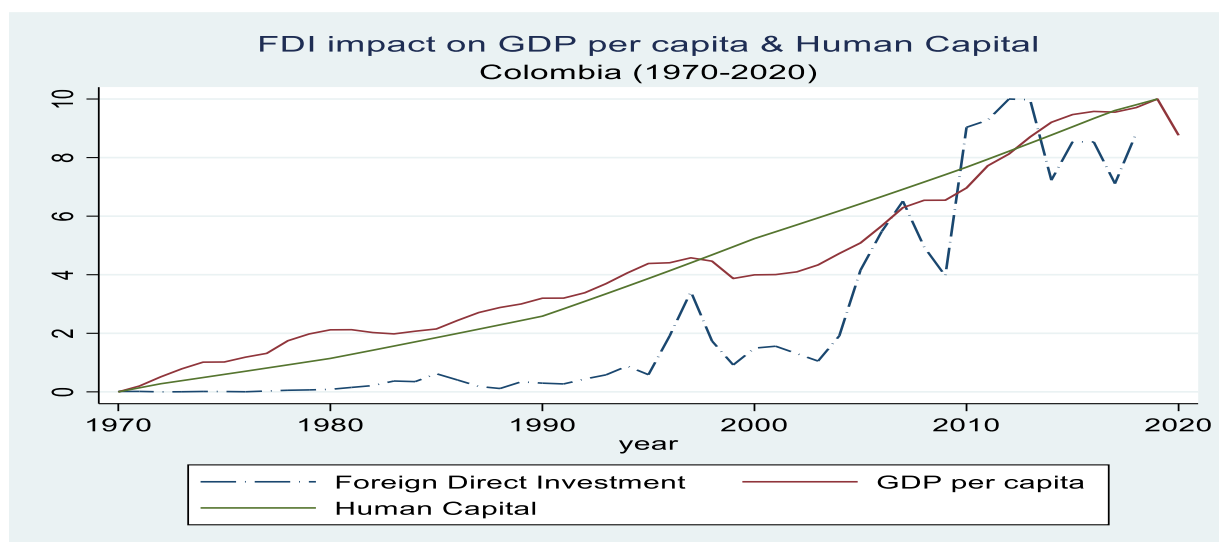
Maximum Rank	LL	Eigenvalue	Trace Statistics	Critical Value (5%)
		Johansen Cointegration Test		
0	210.2254	.	187.534	5%
1	254.3987	0.97081	99.1875	94.15
2	276.9919	0.83593	54.0011	68.52
3	288.6389	0.60614	30.7071	47.21
4	296.3146	0.45885	**15.3557***	29.68
5	302.1234	0.37168	3.7381	15.41
6	303.9924	0.13888		3.76

Table 2:

Unit Root Test: Dicky Fuller & Phillip-Perron Tests

Variables	ADF Test		PP Test	
	Test Statistics	p-value	Test Statistics	p-value
Log GDP per capita	-2.804	0.0037	-3.141	0.0237
Log FDI	-7.061	0.0000	-6.745	0.0000
Log Human capital	-4.503	0.0000	-6.424	0.0000
Log Remittance	-6.071	0.0000	-6.898	0.0000
Log Gross domestic saving	-3.969	0.0001	-5.737	0.0000
Log Battle deaths	-4.728	0.0001	-7.529	0.0000
Log Net trade	-3.064	0.0274	-3.27	0.0163
Log Inflation rate	-5.504	0.0000	-8.216	0.0000
Log Exchange rate	-5.504	0.0000	-2.954	0.0395

*All the variables are differenced

Table 3:

Error Correction Model Results

Tests	Models			
	I	II	III	IV
Durbin-Watson Test	2.71	2.38	2.38	2.51
Omitted Variable Bias Test/Ramsey Test H0: The model has no omitted variables	0.06	0.20	0.19	0.24
Breusch-Pagan/Heteroskedasticity Test H0: Model has constant variance	0.25	0.60	0.62	0.62

Table 4:

The Long-Run Relationship Between FDI
Human Capital, Gross Domestic Saving, Trade, and Per Capita GDP Growth

VARIABLES	Model I GDP per capita	Model II GDP per capita	Model III GDP per capita	Model IV GDP per capita
log Foreign direct investment, net inflows (BOP, current US$) = D	**0.0273****	**0.0175***	**0.0177***	**0.0178***
	(0.0096)	(0.0088)	(0.0087)	(0.0091)
log Human capital index, based on years of schooling = D	-3.2549	-0.8813	-0.9564	-0.9516
	(2.5935)	(2.7017)	(2.5136)	(2.6094)
log Gross domestic savings (current US$) = D	**0.2263*****	**0.1854*****	**0.1866*****	**0.1909*****
	(0.0667)	(0.0567)	(0.0550)	(0.0574)
log Battle deaths in the civil war (yearly deaths) = D	**-0.0052****	-0.0038	-0.0038	-0.0035
	(0.0020)	(0.0024)	(0.0022)	(0.0023)
log Inflation, consumer prices (annual %) = D	-0.0051	0.0093	0.0094	0.0100
	(0.0175)	(0.0149)	(0.0143)	(0.0151)
log Real effective exchange rate index (2010 = 100) = D	0.0405	-0.0062	-0.0059	-0.0037
	(0.0501)	(0.0396)	(0.0381)	(0.0405)
log GDP per capita (current US$) = L	0.4128	0.1703	0.1619	0.1448
	(0.2445)	(0.2427)	(0.2136)	(0.2250)
log Foreign direct investment, net inflows (BOP, current US$) = L	0.0081	**0.0146***	**0.0147***	**0.0150***
	(0.0096)	(0.0071)	(0.0069)	(0.0074)
log Human capital index, based on years of schooling = LD	**5.4302****	**5.8514****	**6.4076*****	**6.2746*****
	(2.1537)	(2.3562)	(1.4821)	(1.6183)
log GDP per capita (current US$) = L2	0.1052	0.1612	0.1639	0.1736
	(0.1085)	(0.1187)	(0.1112)	(0.1122)
log Foreign direct investment, net inflows (BOP, current US$) = L2		-0.0021	-0.0018	-0.0023
	(0.0071)	(0.0068)	(0.0062)	(0.0066)
log Human capital index, based on years of schooling = L2D	0.0756	0.7435	0.7811	0.9280
	(1.9900)	(2.1212)	(2.0069)	(2.0550)
Log FDI * human capital (t-1)		0.7900		
		(3.0491)		
Log Human-capital * GDP-pc(t-1)				225.5548
				(238.6063)
Constant	0.0056	0.0102	0.0103	0.0102
	(0.0089)	(0.0083)	(0.0077)	(0.0079)
Observations	27	27	27	27
R-squared	0.8699	0.8296	0.8295	0.8315

Robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 5:

The Short-Run Relationship Between FDI
Human Capital, Gross Domestic Saving, Trade, and Per Capita GDP Growth:

VARIABLES	Model I GDP per capita	Model II GDP per capita	Model III GDP per capita	Model IV GDP per capita
log Foreign direct investment, net inflows (BOP, current US$) = D	0.0199*	0.0113	0.0135*	0.0089
	(0.0088)	(0.0076)	(0.0075)	(0.0065)
log Human capital index, based on years of schooling = D	-0.8530	2.3836	1.4914	3.4095**
	(2.9402)	(3.5617)	(2.8619)	(1.2433)
log Gross domestic savings (current US$) = D	0.1642**	0.0961	0.1177*	0.0092
	(0.0664)	(0.0790)	(0.0624)	(0.0419)
log Battle deaths in the civil war (yearly deaths) = D	-0.0079**	-0.0074	-0.0066	-0.0085***
	(0.0034)	(0.0050)	(0.0038)	(0.0026)
log Inflation, consumer prices (annual %) = D	-0.0043	0.0096	0.0099	0.0223*
	(0.0141)	(0.0157)	(0.0147)	(0.0116)
log Real effective exchange rate index (2010 = 100) = D	-0.0241	-0.0748	-0.0611	-0.1463***
	(0.0585)	(0.0548)	(0.0435)	(0.0323)
log GDP per capita (current US$) = L	0.4950*	0.2598	0.2152	
	(0.2399)	(0.2442)	(0.2125)	
log Foreign direct investment, net inflows (BOP, current US$) = L	0.0008	0.0069	0.0085	
	(0.0099)	(0.0085)	(0.0080)	
log Human capital index, based on years of schooling = LD	5.0863	2.4750	5.4853***	
	(2.9318)	(3.6913)	(1.4685)	
log GDP per capita (current US$) = L2	-0.0289	0.0075	0.0429	
	(0.1291)	(0.2092)	(0.1747)	
log Foreign direct investment, net inflows (BOP, current US$) = L2	-0.0047	-0.0047	-0.0032	
	(0.0081)	(0.0082)	(0.0076)	
log Human capital index, based on years of schooling = L2D	-0.7939	-0.6061	-0.2647	
	(1.9315)	(2.3747)	(2.0118)	
Log FDI * Human capital (t-1)		3.9492		
		(4.2793)		
Error Correction Model I [ECM(t-1)]	-0.7461			
	(0.4494)			
Error Correction Model II [ECM(t-1)]		-0.5454		
		(0.3755)		
Error Correction Model III [ECM(t-1)]			-0.4646	
			(0.3072)	
Log Human-capital * GDP-pc(t-1)				184.9531
				(224.9116)
Error Correction Model IV [ECM(t-1)]				-0.7270***
				(0.2030)
Constant	0.0129	0.0162*	0.0156**	0.0273***
	(0.0080)	(0.0078)	(0.0071)	(0.0044)
Observations	26	26	26	26
R-squared	0.9344	0.8527	0.8485	0.8084

Robust standard errors in parentheses
***p 0.01, **p < 0.05, *p< 0.1

Table 6: **Mediation Analysis Results (1970 -2019)**

VARIABLES	Model I: Tertiary enrollment			Model I: Human capital		
	GDP per capita	Tertiary enrollment		GDP per capita	Human capital	
Log Tertiary enrollment	0.0863					
	(0.0778)					
Log FDI	0.0028	0.0107		0.0044	-0.000052	
	(0.0067)	(0.0127)		(0.0066)	(0.00029)	
VAR (GDP per capita)			0.00045***			0.00045***
			(0.00009)			(0.00009)
VAR (Tertiary enrollment)			0.0016***			
			(0.00034)			
Log Human capital				-1.60645		
				(3.3438)		
VAR (Human capital)						0.000001***
						(0.00001)
Constant	0.01508***	0.0523***		0.0194***	-0.000006	
	(0.00520)	(0.0061)		(0.0032)	(0.00014)	
Observations	46	46	46	47	47	47

Standard errors in parentheses
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 7:

Colombia: Tertiary Institutions 2021
(Change between 2000 & 2021)

	Public	Private	Total
Universities	49(+10)	77(+5)	126(+15)
University Institutions	27(+6)	61(+43)	88(+49)
Technological Institutions	6(+9)	32(+10)	38(+19)
Professional Technical Institution	9(no change)	22(+3)	31(+3)
Total	91(+25)	192(+61)	283(+86)

Source: OECD and the Colombia Ministry of National Education

Table 8:

Granger Causality Test Results

Equation	Excluded	chi2	df	prob > chi2
GDP per capita	FDI	34.562	6	**0.000**
GDP per capita	Human capital	19.98	6	**0.003**
GDP per capita	All	46.576	12	**0.000**
FDI	GDP per capita	10.998	6	**0.088**
FDI	Human capital	19.937	6	**0.003**
FDI	All	24.103	12	**0.020**
Human capital	GDP per capita	15.361	6	**0.018**
Human capital	FDI	31.642	6	**0.000**
Human capital	All	38.05	12	**0.000**

* Time >= 6 years

Table 9:

Model I: Summary GDP Per Capita (1970–2020)

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
GDP per capita	51	**5036.07***	1429.98	2879.25	7843.54
GDP per capita growth	51	1.9228	2.539	-7.842	6.071

Table 10:

Model I: Predictive Increase in GDP Per Capita

	Margin	Std. Error	t	P >|t|	[95% Conf. Interval]
Dollar Value	120.9	15.13	7.99	0.000	87.184 - 154.615
Percent	**0.02067***	0.00266	7.78	0.000	0.01475 - 0.0266

* When applying   0.02067 * 5036.07 = 104.12