

# Education and inequality: differential economic returns in Colombian cities

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## Introduction

Metropolitan areas in Colombia play a central role in the country's economic development, serving as genuine hubs of employment opportunities. This analysis aims to examine the impacts of education in these areas, specifically those most relevant to the Gross Domestic Product (GDP) of the State of Colombia (Departamento Administrativo Nacional de Estadística - DANE, 2022). The goal is to understand how investment in academic training affects individuals' professional trajectories and economic indicators. "Returns to education", from the perspective of human capital theory, refer to the economic and non-economic benefits derived from educational investment (Becker, 1983), especially in the context of Colombia's metropolitan areas, where these returns can be significant and vary based on educational levels and employment sectors (Gómez et al., 2015).

In these urban areas, a diversity of educational institutions is identified, ranging from local schools to prestigious universities (Gómez, 2013). Although access to higher education is generally more accessible than in rural areas, challenges related to equity and educational quality persist. This context establishes the necessary framework for understanding returns on education investment in the metropolitan labor market (Álvarez et al., 2021; Basten & Haamann, 2018).

Individuals who invest in education in metropolitan areas experience substantial economic returns, especially in high-demand sectors such as technology, finance, and health (Salcedo, 2013). The connection between higher education levels and higher salaries is palpable, standing out in a highly competitive metropolitan labor market that favors those with specialized skills and advanced academic training (Vera & Blanco, 2019). Higher education not only expands job opportunities but also facilitates access to roles of greater responsibility. Professionals with university degrees have greater chances of leading and participating in innovative sectors, contributing to dynamism and innovation in these urban areas (Rodríguez, 2016).

The central hypothesis of this article asserts that investment in education in Colombia's metropolitan areas generates significant returns in terms of income, labor mobility, and professional development. It is anticipated that this relationship between education and career success will be more pronounced compared to non-metropolitan areas, given the greater competitiveness and diversity of opportunities present in these urban environments.

Finally, the guiding question for this research is as follows: How is the relationship configured between investment in education and economic returns, labor mobility, and the impact on competitiveness, innovation, and sustainable development in Colombia's metropolitan areas, considering the dynamics of these urban environments and their influence on the construction of professional trajectories and the socio-economic development of individuals?

The results derived from the application of the Heckman procedure (1979) for the male subsample reveal patterns like those obtained for the female subsample (Rosero & Gómez, 2025; Gómez, 2014). Firstly, the lambda coefficients (3) indicate an absence of selection bias. Additionally, a statistically significant negative correlation at the 1% level is observed in the selected variables, suggesting that unobserved characteristics such as motivation, skills, and other attributes associated with productivity play a crucial role in determining individual incomes (Gómez & Barbosa, 2014; Schultz, 1961).

The results revealed a marked gender gap: men obtain significantly higher educational returns than women, even with similar levels of education. Bogotá had the highest returns, followed by Medellín and Manizales, while regions such as the Caribbean and Pacific regions showed lower benefits. This disparity is attributed to labor dynamics that favor men in higher-paid sectors and to structural biases in the labor market (Rodríguez *et al.*, 2021). The variables linked to the Human Capital theory follow the trend described in the literature for this type of estimation. Returns to potential work experience are significant at the 1% level in most cases, indicating that labor incomes tend to follow an upward trajectory that gradually slows down over the course of most occupational lifespans (Gómez & Rojas, 2015). Moreover, education coefficients reflect the returns associated with each additional year of education, highlighting the importance of academic training in income determination (Gaspar, 2021; Becker *et al.*, 1990).

To conclude, data from the year 2022 provided by DANE were used to delimit the analysis of education returns in the metropolitan areas of the Colombian State. This choice is based on the observation that three departments contribute significantly, representing 60% of the Gross Domestic Product (CEPAL, 2019). It is also noteworthy that data from the year 2020 were not used due to the presence of the pandemic, as substantial errors were identified that could distort the results (Martínez *et al.*, 2020). It is important to note that the estimation results, both for the female and male subsamples. These tables focus on Bogotá, which serves as the base within the 13 metropolitan areas of Colombia and represents the highest contributor to the GDP.

The results obtained for both the male and female subsamples reflect consistency with the specialized literature on human capital (UNICEF, 2020). Firstly, the data indicate the existence of a gender gap. Although women, on average, exhibit superior both soft and hard skills and have a lower school dropout rate, their educational outcomes, with similar job characteristics, are inferior to those of men (DANE, 2020). Secondly, it is observed that the higher returns to education in metropolitan areas, compared to Bogotá, the capital, align with territories that have higher business activity (López *et al.*, 2025; Rodríguez *et al.*, 2021).

In particular, the metropolitan areas of Medellín, Manizales, and Bucaramanga stand out, obtaining the highest educational returns for both the female and male subsamples. These findings coincide with the data from the year 2022, where Bogotá and the departments of Valle and Antioquia contribute 50% to Colombia's GDP, reflecting an amount of 1,465.52 billion Colombian pesos at current prices (DANE, 2022).

The data indicate that, in general, metropolitan areas that are more competitively and, in some cases, geographically distant from Bogotá, show lower returns to education (Ministry of Commerce, Industry, and Tourism, (Romashkina *et al.*, 2020). For example, both in the Caribbean Region with the metropolitan areas of Cartagena, Barranquilla, and Montería, and in the Pacific Region with Pasto, and in the Andean Region with Cúcuta, lower educational returns are evident in both subsamples (Rodríguez, 2024).

Investment in education in metropolitan areas plays a fundamental role in facilitating both social mobility and professional development of individuals (Gómez & Rojas, 2014; Becker, 1964). Those with a solid academic background are better prepared to adapt to changing work environments and seize growth opportunities within their careers. Additionally, the association between education and employability allows professionals to successfully overcome emerging labor challenges (Maldonado, 2021; Hernández *et al.*, 2010).

In a metropolitan environment characterized by competition and constant economic dynamics, education becomes a determining factor for labor productivity and competitiveness (Laverde *et al.*, 2020). Individuals with advanced technical skills and specialized knowledge contribute significantly to the economic development of metropolitan areas (Téllez *et al.*, 2022; Hinojo *et al.*, 2020). The ability

to innovate and adapt to changing demands of the labor market improves significantly with continuous education (Rincón & Gómez, 2023).

The influence of education in metropolitan areas goes beyond purely economic aspects, extending to the realm of sustainable development. Educated professionals are more inclined to participate in civic initiatives, promote responsible business practices, and advocate for sustainable development (Vera & Blanco, 2019; Angulo, 2017). The intrinsic connection between education and social responsibility strengthens the foundation for sustainable and equitable growth in these metropolitan areas (Álvarez *et al.*, 2018; Ibagón & Gómez, 2018).

## Conclusions

The data suggests the presence of a gender gap in metropolitan areas, where the highest returns to education are observed, firstly in Bogotá, followed by Medellín and Manizales in second and third place, respectively, for both the female and male subsamples. Returns to education in the metropolitan areas of Colombia are evident across various dimensions, ranging from economic to social aspects. Investment in education emerges as a key catalyst for individual and collective progress in these dynamic environments. To fully harness these returns and ensure inclusive development, it is essential to continue strengthening education policies that promote equity and quality in the country's metropolitan areas.

It is crucial to note that returns to education in Colombia can be significant and vary depending on the educational level and employment sector. However, it is important to recognize that these returns may also be influenced by diverse factors, such as the individual's socioeconomic level and government policies regarding education and employment. In this regard, the continuous improvement of these policies emerges as an essential element to maximize the benefits of educational investment in the country.

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