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Returns to education in Colombia: Impact of human capital in times of change

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Abstract: The general objective of the article is to critically examine the application of Human Capital Theory and assess the returns to education for economists, accountants, and business administrators in the Colombian context, specifically during and after the COVID-19 pandemic. The methodology employed is quantitative, utilizing a micro-econometric model based on Mincerian equations, analyzing data from the Gran Encuesta Integrada de Hogares (GEIH) of DANE for the years 2018, 2019, 2021, and 2022. The main findings indicate that investment in education is revealed as an essential strategy to optimize human capital, promote economic development, and contribute to overall well-being in a dynamic and challenging economic environment. Additionally, it is concluded that the returns to education for Colombian economists are higher than those of other professions, evidencing a gender bias in remuneration. These results underscore the importance of education in the socio-economic resilience of the country.

Keywords: *Employment, Labour, Market economy, Transition economies.*
JEL Classification: *C50; D31; J31; J41.*

1. Introduction

The Human Capital Theory, originally developed by economists such as Becker (1964, 1983), provides a robust theoretical foundation for analyzing the returns to education, particularly in the context of Colombian economists navigating the post-COVID-19 landscape. Becker's framework posits that education serves not only as a mechanism for acquiring knowledge and technical skills but also as a form of investment that enhances an individual's productivity, ultimately driving both individual and broader economic development (Gómez et al., 2015; Becker et al., 1990). This view underscores education as a critical component in the formation of human capital, contributing to economic growth through increased labor productivity and innovation.

In the post-pandemic era, Colombian economists face complex challenges that necessitate advanced, specialized knowledge and an ability to adapt quickly to shifting economic conditions (Rodríguez, 2016; Gómez & Rojas, 2014). Human Capital Theory suggests that investments in higher education and continuous learning generate significant economic returns by equipping individuals with enhanced cognitive abilities, problem-solving skills, and the analytical acumen required to navigate the complexities of a rapidly evolving economic environment (Rincón & Gómez, 2023; Rodríguez, 2005; Prada, 2006). Furthermore, the theory argues that education fosters economic resilience by preparing individuals to address both micro and macroeconomic shifts triggered by external shocks, such as the COVID-19 pandemic (Chavarro et al., 2022).

The returns to education, viewed through the lens of Human Capital Theory, manifest in various forms. First, there is a marked increase in employability and labor mobility for economists who have pursued advanced academic training. The acquisition of specialized, up-to-date skills not only enhances individual productivity but also augments the capacity to influence strategic decision-making processes

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at both organizational and governmental levels (García & Forero, 2018; Contreras & Barbosa, 2013). These returns are not merely economic; education also improves non-monetary aspects such as health, well-being, and emotional intelligence, which are essential for sustainable workforce performance and effective team collaboration (Laverde et al., 2020; Gómez & Rojas, 2015). This expanded definition of human capital, which includes social and emotional competencies, broadens the scope of education's impact beyond mere technical proficiencies, acknowledging its role in fostering holistic personal development and workplace efficiency.

In Colombia, the return to education among economists is driven not only by the competitive pressures of a demanding labor market but also by a collective aspiration to contribute to the country's socio-economic progress (Galvis, 2010; Farné, 2006). Human capital investments are seen as pivotal strategies for enhancing national productivity and addressing contemporary economic challenges, such as those exacerbated by the pandemic (Álvarez et al., 2021; Barceinas et al., 2001; Cardona et al., 2007). Education, therefore, becomes a cornerstone for enabling economists to assume leadership roles in shaping Colombia's economic recovery and fostering long-term resilience in the face of future crises.

The COVID-19 pandemic has irrevocably altered global and national dynamics, exerting profound effects across various sectors, including education and labor markets. In Colombia, the pandemic has prompted a renewed emphasis on the role of education as a key lever for economic recovery and sustainable development (Chavarro et al., 2022; Barbosa et al., 2021). The crisis has amplified the need for economists to develop specialized skills, particularly in digital literacy, data analysis, and policy formulation, which are increasingly critical in an unpredictable and fluid economic environment. As a result, the decision to return to education reflects a broader strategic response to the economic upheavals caused by the pandemic, aiming to equip professionals with the tools necessary to drive innovation and contribute to the country's socio-economic resilience (Gómez, 2018; Angulo, 2017; Gómez & Barbosa, 2014; Ardila, 2013).

This analysis posits that the Human Capital Theory and the concept of returns to education will experience substantial shifts during and after the COVID-19 pandemic. While investments in human capital will continue to play a central role in Colombia's economic and social development, the nature of the returns to education will be shaped by the evolving demands of the labor market and the unique challenges presented by the pandemic. The pandemic has catalyzed the digital transformation of many industries, requiring new competencies that may alter traditional pathways of educational investment and return. Therefore, the article hypothesizes that the post-pandemic period will see an increased emphasis on interdisciplinary education, lifelong learning, and the integration of digital technologies into economic analysis and policy development.

In this context, the article is structured to examine the quantitative methodology used to assess the returns to education for Colombian economists, followed by an in-depth discussion of the results. The study concludes by offering insights into how Human Capital Theory may evolve in response to the long-term impacts of the pandemic and outlining policy recommendations for enhancing the productivity and competitiveness of Colombia's human capital in a post-COVID-19 world.

2. Methodology

The primary data source for this analysis is derived from the Microdata of the Gran Encuesta Integrada de Hogares (GEIH) for the years 2018, 2019, 2021, and 2022, collected by the Departamento Administrativo Nacional de Estadística (DANE). From a methodological standpoint, surveys are robust instruments for capturing social phenomena, and they are extensively utilized in labor economics to evaluate workforce dynamics, income distribution, and employment trends (Montenegro & Schroeder, 2017; McConnell et al., 2003). In this particular study, the sample was restricted to individuals in professions delineated by DANE, which ensures consistency with official labor classifications and enhances the relevance of the findings for labor market analyses.

Within the framework of the Mincerian Functions, this study proceeds to estimate the returns on Human Capital variables in relation to the wage income of Colombian economists during the specified

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time period (Valencia, 2005). The approach is rooted in the income function introduced by Jacob Mincer in 1974, which is widely regarded as one of the most influential models in the field of labor economics for understanding the relationship between education, experience, and earnings. Specifically, the Mincer equation posits that the logarithm of wage income is a linear function of years of education and work experience, serving as proxies for the accumulation of human capital (Mincer, 1974; 1970). This relationship allows for the quantification of the return to education—often termed "returns to schooling"—and other forms of human capital, such as on-the-job experience (Gómez, 2014).

The Mincerian income model applied to the GEIH data captures this dynamic by incorporating key Human Capital variables such as education level, work experience, and job tenure. The functional form of the model is expressed as follows:

$$\ln(y) = \beta 0 + \beta 1 + \beta 2\exp + \beta 3\exp 2 + \varepsilon \quad (1)$$

Where:
Y: income of the individual.
S: number of years of formal education.
Exp: number of years of work experience.
work experience.
ε: random term that cannot explain the model.

This model facilitates the estimation of the economic returns to education by interpreting the coefficient $\beta 1$ as the percentage change in wages associated with an additional year of schooling. The inclusion of the squared experience term (Exp) allows for the modeling of the concave relationship between experience and wages, which typically reflects a growth in earnings with experience that eventually tapers off (Valencia, 2005). By applying this model to the GEIH dataset, the study provides an empirical assessment of how human capital investments, particularly in the form of education, influence the wage outcomes of Colombian economists in the labor market.

Moreover, this approach enables a nuanced understanding of the labor market dynamics post-COVID-19, as shifts in wage structures and employment opportunities may have altered the returns to education and experience during the pandemic period. This analysis not only provides insights into individual wage determinants but also contributes to broader discussions on the role of human capital in promoting economic recovery and resilience in the face of external shocks (Gómez, 2014; Chavarro et al., 2022).

Micro econometric model

$$\text{Ln Yi} = \beta 0 + \beta 1\ \text{expi} + \beta 2\ \text{expi}2 + \beta 3\text{Edu}\ 1 + \beta 4\ \text{Edu}\ 2 + \beta 5\ \text{Disciplina} + \beta 6\text{Disciplina}1i + \beta\ \text{Disciplina}\ 2i + \beta 7 + f1 + \varepsilon \quad (2)$$

Where:
Ln yi = income of wage earners in logarithmic form.
exp = experience of the worker. exp2 = experience of the worker squared.
pri = primary school level.
sec = secondary school level.
uni = university level.
Discipline = represents the professions.
k = number of occupations.

This methodological approach, grounded in the rigor of the Mincer income function, provides a comprehensive framework for analyzing the impact of Human Capital variables on the labor income of Colombian teachers. By employing this model, the analysis gains robustness in its ability to isolate the effects of education and work experience on wages, a critical dimension in labor economics research (Calderón, 2011; Isaza, 2003; 2001). The application of this approach not only allows for a detailed examination of wage determinants but also aligns with established scientific standards, making it an effective tool for addressing the nuances of wage structures within labor markets.

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Additionally, dummy variables are used to account for differential effects across cities and occupations, enabling the model to capture geographic and sector-specific variations in wage outcomes (Riascos & Erazo, 2010; Mérlo, 2009). The anticipated signs of the coefficients are positive for education and experience, indicating that higher education and more experience led to increased wages, while the quadratic term for experience is expected to have a negative sign, reflecting diminishing returns over time.

The econometric model also incorporates the Heckman correction (Heckman, 1979), addressing potential selection bias. This correction is crucial in labor economics research where the sample may not be fully representative of the target population. Specifically, individuals participating in the labor market may possess unobservable characteristics—such as motivation, ambition, or innate ability—that correlate with higher wages. These unobservable traits, if not accounted for, can introduce omitted variable bias, skewing the coefficients of the wage equation (Moss, 2020; Hansen, 2006). By applying the Heckman procedure, the analysis corrects for this bias, yielding more accurate and reliable estimates of the returns to human capital.

The Heckman model consists of two stages. The first stage estimates a probit model of labor market participation, where the probability of an individual being employed is modeled as a function of observable variables. From this, a selection term, known as the inverse Mills ratio (λ), is derived. This selection term captures the effects of unobserved variables that influence both labor market participation and wages. In the second stage, this selection term is included in the wage equation to correct for selection bias. Although the exact effects of unobservable characteristics cannot be directly estimated, the inclusion of the selection term mitigates their impact, thus refining the estimated coefficients of the observed variables in the model (Farné & Vergara, 2008).

Additionally, the study will extend the analysis by estimating separate wage equations for men and women to explore gender disparities in wage determination. This disaggregation allows for a deeper understanding of the gender wage gap, highlighting differences in the returns to education and experience between men and women. Such an approach is particularly important in light of existing empirical evidence suggesting that gender discrimination, occupational segregation, and differential access to educational opportunities contribute to wage inequality (Harmon et al., 2001; Rodríguez, 1981). The gender-specific wage equations are given as:

$$\text{Ln (f)} = \text{Xf} * \beta\text{f} + \sigma\text{f}\lambda\text{f} + \text{Uf}\pi\text{r2} \quad (3)$$

$$\text{Ln (Wm)} = \text{Xm} * \sigma\text{m}\lambda\text{m} + \text{Um} \quad (4)$$

Where Wi = Column vector of the logarithm of the hourly wage of the individual of sex i.

Xi = Matrix containing the observed characteristics of the individuals.

Bi = Vector of coefficients to be estimated.

λ = Correction term.

σ = Covariance between the unobservable factors affecting labour participation and those affecting wages.

Ui = Random disturbance term, where E (u)=0 (Freire & Terjeiro, 2010; Barraza, 2010).

3. Results

The estimates of the labor income equation model, as outlined in equation (2), are provided in Tables 1 and 2. These tables summarize the econometric results based on the annual microdata from the Gran Encuesta Integrada de Hogares (GEIH) for the years 2018, 2019, 2021, and 2022, comprising a total of 911,000 observations. The dataset includes both the economically active and inactive population, offering a comprehensive representation of the labor market dynamics in Colombia. However, data from 2020 were excluded from the analysis due to robust errors in the dataset, which either overestimated or underestimated the results, likely reflecting the volatility caused by the COVID-19 pandemic and its impact on data collection and reporting.

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The tables present the estimated coefficients for the labor income equations, incorporating the selection effects corrected by the Heckman (1979) two-step procedure. This method was applied separately for male and female subsamples, allowing for an in-depth comparison of the returns to education and experience across genders. The earnings equation coefficients for the various occupational categories are statistically significant, indicating that the key variables (education, experience, and city/occupation dummies) are strong predictors of wage income for both men and women.

The results for the male subsample reveal no significant selection bias, as evidenced by the insignificance of the lambda coefficients derived from the inverse Mills ratio. The absence of selection bias suggests that the sample of employed males is representative of the broader population of working-age men. Furthermore, the statistically significant negative correlation observed between certain variables—specifically at the 1% significance level—implies that unobserved characteristics, such as motivation, ability, and other attributes tied to productivity, play a crucial role in determining an individual's wage (Isaza, 2013). These unobserved factors, which are not directly captured by the model, exert a significant influence on labor income, highlighting the importance of including a correction for potential selection bias when analyzing wage equations.

For the female subsample, similar findings are presented. The coefficients for education and experience in the earnings equation are significant, confirming the importance of human capital variables in determining labor income. However, differences in the magnitude of these coefficients compared to the male subsample point to persistent gender wage disparities, likely reflecting both labor market discrimination and differences in labor force participation patterns. This is consistent with findings from previous research on gender wage gaps, which often point to the undervaluation of women's labor and the impact of occupational segregation on wage outcomes (Farné & Vergara, 2008; Moss, 2020).

The Heckman selection model proves instrumental in this analysis, as it allows for the identification of potential biases stemming from non-random labor market participation. While the lambda coefficients suggest that selection bias is not a major concern in this dataset, the significant negative correlation between unobserved characteristics and income underscores the complexity of wage determination and the multifaceted nature of human capital. Future research may delve deeper into the role of these unobserved characteristics and explore their interactions with other labor market factors, such as job tenure, industry-specific skills, and geographic mobility.

Table 1.
Income equations for the male sub-sample.

	Year			
Professions	**2018**	**2019**	**2021**	**2022**
Specialists in physico-chemical sciences	0.7039***	0.7044***	0.7101***	0.6999***
Architects, engineers and technicians asmilados	0.7306***	0.7388***	0.7401***	0.7021***
Pilots and deck officers	1.2083***	1.3001***	1.3083***	1.2001***
Dentists, veterinary surgeons and assimilated workers	0.6502***	0.6555***	0.6612***	0.6411***
Biologists, agronomists and technicians	0.7906***	0.7983***	0.8101***	0.7918***
Nursing	0.4373***	0.4299***	0.4266***	0.4213***
Statisticians, mathematicians, systems systems analysts and similar technicians	0.5515***	0.5573***	0.5599***	0.5501***
Economists	0.7940***	0.8317***	0.8594***	0.8424***
Counters	0.5617***	0.5823***	0.5787***	0.5522***
Jurists	0.6530***	0.6500***	0.6714***	0.6499***
Teachers	0.6615***	0.6534***	0.6619***	0.6586***

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Authors, journalists and writers assimilated	0.2471***	0.2517***	0.2479***	0.2433***
Administrators	0.6006***	0.6101***	0.5781***	0.5814***

Table 2.
Income equations for the female sub-sample.

	Year			
Professions	**2018**	**2019**	**2021**	**2022**
Specialists in physico-chemical sciences	0.6974***	0.7002***	0.7009***	0.6985***
Architects, engineers and technicians asmilados	0.7288***	0.7132***	0.7145***	0.7243***
Pilots and deck officers	-259	-244	-192	-182
Dentists, veterinary surgeons and assimilated workers	0.5901***	0.5666***	0.6002***	0.5917***
Biologists, agronomists and technicians	0.7683***	0.7746***	0.7618***	0.7522***
Nursing	0.4809***	0.4714***	0.4779***	0.4801***
Statisticians, mathematicians, systems systems analysts and similar technicians	0.6394***	0.6146***	0.6182***	0.6256***
Economists	0.6927***	0.6845***	0.6802***	0.6768***
Counters	0.5544***	0.5423***	0.5487***	0.5517***
Jurists	0.7692***	0.7690***	0.7433***	0.7601***
Teachers	0.5648***	0.5615***	0.5582***	0.5568***
Authors, journalists and writers assimilated	0.5743***	0.5222***	0.5686***	0.5671***
Administrators	0.5517***	0.5491***	0.5456***	0.5427***

Source: of both tables Dane DATA
Robust standard errors in brackets. *** denotes significance at 1%, ** denotes significance at 5%, * denotes significance at 10%. denotes significance at 10%. Base category is Salesperson, Shop Assistant.
The names of the trades, occupations and professions are taken from the page http://www.ilo.org/public/libdoc/ilo/1969/69B09_35_span.pdf. Last accessed 30/11/2023

The results of the study indicate that wage disparities persist between male and female economists in Colombia, with men consistently earning more than women, even when controlling for factors such as education, experience, and positions. This aligns with broader research findings on gender wage gaps. For instance, studies suggest that a substantial portion of this gap is often due to differences in the returns to education and experience between genders rather than educational attainment itself (Blau & Kahn, 2017). In the Colombian context, the gender difference in returns to education of -0.16 log points by 2022 reflects this broader pattern of disparity.

The data further suggest that the returns to education for economics graduates, regardless of gender, are higher on average than in most other professions, echoing findings in various sectors where human capital investments yield significant returns. Notably, a spike in these returns was observed in 2021, possibly driven by post-pandemic adjustments in the labor market, which is consistent with global trends of economic recovery following COVID-19 disruptions (Gaspar, 2021; UNICEF, 2020).

However, it is essential to recognize that wage returns tend to vary across professions, with some specific trades, such as pilots, showing higher returns. This occupational disparity can be attributed to the demand for specialized skills, a pattern also found in digitalization-related occupations, which have accelerated post-pandemic (CEPAL, 2019; Vries, 2014). These variations highlight the complex dynamics of education's role in economic returns, particularly in Colombia's rapidly evolving labor market (Téllez et al., 2022;2020)

These findings are consistent with Human Capital Theory, which emphasizes the role of education and skills acquisition in enhancing productivity and earnings. However, the theory also highlights the

need to address structural inequalities in access to education, which the pandemic has exacerbated. In particular, women and those from lower socio-economic backgrounds face greater challenges in accessing education, which could further widen the wage gap (Pons, 2004; Rincón et al., 2017).

Finally, while Human Capital Theory predicts significant returns on educational investment, external factors such as labor market saturation and gender discrimination may limit the actual returns to education for certain groups. This suggests that, in addition to promoting educational investments, policy measures targeting labor market inequalities are necessary to fully realize the potential returns to education (Martinez et *al*., 2020, Weinzimmer & Esken, 2017).

4. Discussion

The paper aligns with the core principles of Human Capital Theory and is strengthened by recent research on how the COVID-19 pandemic has reshaped labor market dynamics. Human Capital Theory, which posits that investment in education increases productivity and income, has been a central framework in labor economics (Becker, 2003; Schultz, 1961 ;1960). In the context of the Colombian labor market, the pandemic has amplified the importance of specialized skills. Those who continuously invest in education and training are more equipped to respond to shifting demands, such as the rise of digitalization (Gómez, 2013). This shift has widened the gap between those with access to such educational opportunities and those without, exacerbating inequality (Basten & Haamann, 2018; Aguilera & Saucedo, 2002).

The findings of the article also corroborate the work of Navarro (2005) and Salas-Velasco (2001), which highlight how education has differential effects across sectors. For instance, the digital economy's acceleration, driven by the pandemic, has resulted in higher returns for those in technology-related fields (Vries, 2014). Moreover, these changes support the argument that the pandemic's impact has been uneven, with gender wage gaps continuing to be a challenge. Studies indicate that despite similar qualifications, women tend to earn less than men (Blau & Kahn, 2017; Escobar & Paternina, 2017)

Research suggests that the demand for digital and adaptable skills will continue to grow, which aligns with the concept that the returns to education, particularly in technology-related areas, will increase. Studies by Rincón et al. (2017) and Barón (2010) emphasize that individuals with such skills will enjoy higher employability and wage returns, reinforcing the relevance of investment in human capital during and post-pandemic (Isaza & Reilly, 2011).

In conclusion, while Human Capital Theory remains a powerful tool for understanding labor market dynamics, the pandemic has shown that it must also be adapted to account for structural inequalities. Those unable to invest in their education due to economic or technological barriers are at risk of falling behind, contributing to long-term socio-economic disparities in Colombia (Téllez et al., 2020; Ibagón & Gómez, 2018). The potential overeducation issue in saturated labor markets, as discussed by Schultz (1961), also warrants attention, especially in fields where the supply of skilled labor exceeds demand (Maldonado, 2021; Weinzimmer & Esken, 2017).

5. Conclusions

The literature on returns to education within the framework of Human Capital Theory is indeed vast. However, its application to specific professional sectors, such as Colombian economists, remains underexplored. This study contributes significantly by narrowing the focus to this particular group during the period of 2018-2022, which includes the socio-economic disruptions caused by the COVID-19 pandemic. Such an analysis is essential for understanding the changing employment landscape and the impact of human capital investment within this specialized guild.

The findings underline the critical need for a tailored approach when applying Human Capital Theory to different sectors. The pandemic has not only reshaped labor market dynamics but has also intensified existing inequalities in access to education. A significant portion of Colombian economists faced differential impacts depending on their ability to adapt to new technologies and digital tools, which are increasingly relevant in the post-pandemic economy. The research stresses that, while

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investment in education remains vital, without addressing structural inequalities, the benefits will be unevenly distributed across different socio-economic groups.

Moreover, the theory's application in the Colombian context reveals that the returns to education are not uniform. Post-pandemic, the returns are likely to vary depending on the individual's access to resources such as technology, networks, and financial capital. This heterogeneity in returns necessitates the design of targeted educational policies that can bridge gaps in access and ensure that education remains a powerful tool for economic mobility. Governments must focus on policies that promote digital inclusion and continuous skill development, ensuring that all members of society, particularly those in marginalized groups, can reap the benefits of their educational investments.

In conclusion, while Human Capital Theory offers a robust framework to analyze the returns to education, it must evolve to incorporate the socio-economic disparities exacerbated by the COVID-19 pandemic. Only by addressing these inequalities can Colombia achieve equitable and sustainable development, where the returns to education are shared broadly across society. This study, therefore, advocates for comprehensive policy reforms that integrate education, technology, and labor market dynamics to enhance human capital in the post-pandemic era.

Expanding on these conclusions, future research should delve into sector-specific analyses, examining how different professions and economic sectors experience varying returns to education. Additionally, longitudinal studies that track educational investments and labor market outcomes over extended periods will be critical for identifying long-term trends in post-pandemic recovery and the ongoing evolution of human capital.

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