

IN-WORK POVERTY ACROSS THE ECONOMIC CYCLE, LIFE CYCLE, AND GENERATIONS: EVIDENCE FROM ECUADOR, 2007-2022

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Abstract

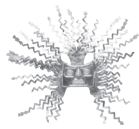
This study examines the influence of age, cohort, and the economic cycle on the evolution of in-work poverty rates in Ecuador, using a pseudo-panel and an Age–Period–Cohort (APC) approach over the period 2007–2022. The results show that the life-cycle effect reveals a decreasing trend in in-work poverty, with increases during middle and old age. The analysis also indicates that the cohort effect decreases with younger generations, suggesting lower in-work poverty rates (IWPR) than their predecessors at the same age. The findings support the counter-cyclical nature of in-work poverty, showing a negative correlation between the period effect and the cyclical component of GDP. Additionally, the analysis reveals that, on average, structural disparities remain, particularly impacting informal workers, those with low educational attainment, rural residents, and agricultural workers. The results imply that labor poverty is a complex phenomenon, influenced by macroeconomic shocks, workers' life cycles, and generational shifts. Furthermore, the behavior of these three factors varies substantially across worker groups, highlighting the need to account for this heterogeneity. Recognizing these differences is crucial for developing policies that not only address the structural causes of labor poverty but also account for the diversity in labor trajectories and economic conditions.

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LA POBREZA LABORAL A LO LARGO DEL CICLO ECONÓMICO, DEL CICLO DE VIDA Y ENTRE GENERACIONES: EVIDENCIA PARA ECUADOR, 2007-2022

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Resumen

Este estudio examina la influencia de la edad, la cohorte y el ciclo económico en la evolución de la tasa de pobreza laboral en Ecuador, utilizando un pseudo-panel y un enfoque edad-periodo-cohorte (APC) durante el periodo 2007-2022. Los resultados empíricos evidencian que el efecto del ciclo de vida muestra una tendencia decreciente en la pobreza laboral, con un repunte en la edad media y la vejez. La investigación también muestra que el efecto de cohorte es decreciente para las nuevas generaciones, lo que indica niveles de tasa de pobreza laboral (TPL) más bajos que los de sus antecesores a la misma edad. Los resultados confirman el carácter contracíclico de la pobreza laboral, al evidenciar una relación negativa entre el efecto periodo y el componente cíclico del PIB. El análisis presenta que, en promedio, persisten brechas estructurales que afectan principalmente a los trabajadores informales, aquellos con bajos niveles educativos, los que residen en zonas rurales y quienes se desempeñan en actividades agrícolas. Los resultados sugieren que la pobreza laboral es un fenómeno multifacético, influenciado por shocks macroeconómicos, el ciclo de vida de los trabajadores y las transformaciones generacionales. Además, el comportamiento de estas tres dimensiones varía significativamente entre distintos tipos de trabajadores, lo que constituye un factor adicional que debe ser considerado. Reconocer estas diferencias es clave para diseñar políticas que no solo distingan entre las causas estructurales de la pobreza laboral, sino que también respondan a la heterogeneidad de trayectorias laborales y condiciones económicas.

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1. INTRODUCTION

Although employment has traditionally been viewed as a key tool in combating poverty, this perspective has been increasingly challenged due to the growing number of workers unable to achieve decent living conditions (Fleury & Fortin, 2006). This phenomenon, known as in-work poverty, refers to individuals who, despite being employed, live in households with insufficient income to escape poverty (Gammarano, 2019; Maurizio, 2018). In Ecuador, the in-work poverty rate (IWPR) has shown significant fluctuations over the past sixteen years, declining from 31,69 % in 2007 to 25,98 % in 2022 (Appendix A). These changes reflect the influence of various factors, including the structural conditions of the labor market, macroeconomic context, household characteristics, and social policies (Crettaz, 2011).

The Ecuadorian economy has experienced periods of growth interrupted by recessions. Between 2007 and 2014, uneven growth led to a reduction in underemployment (–5,3 percentage points) and an increase in adequate employment (+6,1 pp) (INEC, 2023b), along with declines in overall poverty (–14,2 pp) and extreme poverty (–8,8 pp) (INEC, 2022), driven by rising wages and stronger enforcement of social security contributions (Maurizio, 2018). However, from 2015 to 2020, shocks such as falling oil prices and the 2016 earthquake caused a decline in adequate employment (–7,7 pp), a rise in informality (+8,6 pp), increased inequality—Gini coefficient 0,473—(INEC (2023a), and poverty rising to 25 % (INEC, 2022).

The COVID-19 crisis (2020–2022) further deepened these challenges, causing a 7,8 % GDP contraction (Macas, 2023), an increase in informality to 64,4 %, a decrease in adequate employment to 29,1 %, and poverty rising to 32,4 % (INEC, 2022). Following the easing of restrictions, a partial recovery began, with informality declining to 60,5 % and adequate employment rising to 35,5 % by 2022 (INEC, 2023b).

When considering the life cycle of workers, Rowntree (1902) identified youth, adulthood with parenting responsibilities, and old age as the most economically vulnerable stages. In Ecuador, as of October 2022, the formal employment rate was 28,2 % among youth aged 18-29, with an average income of USD 346, while for older adults, formal employment stood at 15,4 %, with an average income of USD 237,20, highlighting labor market challenges and poverty risks during these stages (INEC, 2022).

Research indicates that young people face higher risks of in-work poverty due to unstable employment, low wages, and limited access to social security (Bennett, 2017; Filandri & Struffolino, 2019; Tejero, 2017). Additionally, generational changes influenced by education, working conditions, and household composition exacerbate this vulnerability, making younger cohorts more susceptible than previous generations (Fredes, 2021).

Research on in-work poverty in Ecuador remains limited, particularly due to the lack of longitudinal data that track individuals over time, which

hinders understanding beyond short-term economic fluctuations. To address this, the present study employs a cohort analysis and an Age-Period-Cohort (APC) approach based on Deaton and Paxson (1994) and Deaton (2018), using a pseudo-panel constructed from successive surveys covering sixteen years (2007–2022). The study aims to analyze the dynamics of the in-work poverty rate across the life cycle and generations, as well as its relationship with the economic cycle. Accordingly, this study poses the following research questions: To what extent does in-work poverty among Ecuadorian workers differ across the life cycle, generational cohorts, and historical periods?

Therefore, this study makes an important contribution to the literature by examining in-work poverty in Ecuador through a multidimensional lens that incorporates life-cycle stages, generational shifts, and macroeconomic fluctuations. By applying an Age-Period-Cohort (APC) model to a pseudo-panel constructed from nationally representative surveys spanning 2007 to 2022, this research provides additional empirical evidence on the structural and cyclical determinants of in-work poverty. The findings aim to inform more effective public policy responses that address the persistent vulnerabilities of workers—particularly younger cohorts—within a changing economic and labor market context.

The article is structured as follows: first, it presents the theoretical framework and a review of the relevant literature; next, it outlines the methodology used in the analysis; this is followed by a discussion of the main results; and finally, the article concludes with a summary of the key findings and their policy implications.

2. LITERATURE REVIEW

In-work poverty, arising from insecure low-paid jobs, emerged in the U. S. in the 1970s and gained European focus in the 1990s (Domínguez-Olabide, 2022). Vandecasteele and Giesselmann (2018) present Table 1, which shows the possible binary combinations of employment and poverty, where combination B2 defines in-work poverty, while the others represent initial conditions that may lead to this phenomenon.

Table 1. Dimensions of In-Work Poverty

		Household is	
		(1) Non-poor	(2) Poor
The individual is	(A) Not employed	Not employed and non-poor	Not employed and poor
	(B) Employed	Employed and non-poor	Employed and poor

Source: Vandecasteele and Giesselmann (2018)

Elaborated by the authors

In-work poverty lacks a universal definition but is widely seen as a complex interplay between individual and household factors (Domínguez-Olabide, 2022; Tejero, 2017). It refers to paid workers living in households below the poverty line (Cheung & Chou, 2015; Jürgen & Lohmann, 2008; Maurizio, 2018). While employment often reduces poverty, many workers remain at risk despite being employed.

This condition stems from a mismatch between household resources and needs. Influencing factors include macroeconomic elements—such as labor market structure, economic cycles, and institutions—and microeconomic aspects such as age, gender, education, and migration status (Crettaz, 2011; Lohmann & Crettaz, 2018). Household size and composition also matter, as larger families with dependents tend to face greater financial strain (Lohmann & Crettaz, 2018).

2.1. Measurement of Poverty

Filandri and Struffolino (2019) distinguish two approaches to measuring in-work poverty: the individual and the household approach. The individual approach focuses on personal income below 60 % of the national median wage, ignoring household context. The household approach, supported by Maurizio (2018) and Van Winkle and Struffolino (2018), assesses poverty based on total household income—either relative to the median (60 %) or to the cost of a basic basket—considering family size, structure, and financial burdens for a fuller picture of economic well-being.

In accordance with Jürgen and Lohmann (2008), Filandri and Struffolino (2019), Maurizio (2018), and Gammarano (2019), this study adopts the household-based approach to measuring poverty. This perspective is particularly suitable for the Latin American context, as it reflects the distribution of resources within families and accounts for differences in household size and dependency structures. Moreover, Maurizio (2018) argues that the absolute approach constitutes the most appropriate criterion for defining the poverty line in the region, given the substantial evidence that a significant share of

the population continues to lack the resources required to satisfy basic needs. The detailed description of the construction of the in-work poverty variable is presented in the methodology section.

2.2. International Evidence

This section reviews major studies on in-work poverty, a topic extensively studied in Europe and the U. S. Broström and Jansson (2022), analyzing Sweden over 30 years, found long-term improvements shaped by economic cycles and policy reforms, with a shift in the profile of the working poor from native single women to foreign-born married men.

Several studies (Kenworthy & Marx, 2018; Lohmann & Crettaz, 2018; Tejero, 2017; Van Winkle & Struffolino, 2018) link in-work poverty to age, job type, and household structure. Labor poverty fluctuates across life stages. It tends to be higher in early and later adulthood (Cheung & Chou, 2015; Lohmann & Crettaz, 2018), though Tejero (2017) identifies middle age as another period of elevated risk. Van Winkle and Struffolino (2018) further show that this risk decreases over time for men but increases for women.

Job quality plays a crucial role in shaping poverty risk. Part-time and low-wage employment—particularly in the service sector, where wage dispersion is high—increases the likelihood of poverty (Halleröd & Larsson, 2008; Lohmann & Crettaz, 2018; Tejero, 2017). At the structural level, social transfers and higher degrees of de commodification help mitigate this risk (Lohmann, 2008). However, certain groups—such as immigrants, individuals with lower education levels, and low-skilled workers—remain especially vulnerable (Cheung & Chou, 2015).

Beyond these contexts, Lin and Hao (2023) apply an APC model to census and survey data from Hong Kong (1986–2016), analyzing the dynamics of low-paid employment. Their results reveal U-shaped life-cycle patterns, persistent period effects, and generational differences, underscoring the broader applicability of APC methods to labor market phenomena. This strengthens the case for employing APC analysis in the study of in-work poverty.

2.3. Evidence from Latin America

In Latin America, evidence is limited. Maurizio (2018) finds in-work poverty rates in Ecuador and Peru to be 25 % higher than in Brazil, Costa Rica, and Argentina, due to persistent low-quality jobs. In Chile, Maldonado et al. (2018) show that, without public transfers, in-work poverty exceeds the OECD average—driven by high informality, rigid labor rules, and a conservative welfare system favoring older men over youth. Fredes (2021), using an APC model in Chile, finds that younger cohorts face greater risks despite higher education. In-work poverty declines with age and has fallen over time due

to macroeconomic and policy changes, though the analysis lacks controls for other socioeconomic variables.

Additional evidence from Costa Rica and other Latin American countries supports the relevance of cohort, age, and period effects. Brenes Camacho (2014) analyzes household surveys and population censuses from 1981 to 2002, showing that poverty among older adults can be understood as a cohort effect, largely associated with low educational attainment—especially among men—and limited access to retirement pensions.

2.4. Age-Period-Cohort Approach to In-Work Poverty

The Age-Period-Cohort (APC) method analyzes how in-work poverty evolves across individuals' life cycles, over time, and between generations. It decomposes trends into three effects: the age effect, reflecting life cycle changes linked to education, employment, fertility, and marital status; the period effect, capturing macroeconomic shocks such as recessions or pandemics; and the cohort effect, highlighting generational differences among workers entering the labor market in the same year (Amber & Chichaibelu, 2023).

Theories of pro-poor and pro-rich growth help explain how economic growth affects different income groups. In pro-poor growth, the incomes of the poor rise as fast or faster than those of wealthier groups, reducing in-work poverty. In contrast, pro-rich growth leads to rising inequality and persistent or increasing poverty among workers (Campos Vázquez & Monroy-Gómez-Franco, 2016).

The age effect is often tied to income changes over the life course. Rowntree (1902) noted that workers face poverty during key life phases—especially early in their careers or after retirement. Young workers typically earn low wages (Jürgen & Lohmann, 2008), while poverty risk may later shift to middle-aged earners (Lohmann & Marx, 2018). Income usually rises with experience and education but can decline again in later life (Fredes, 2021).

The cohort effect reflects generational differences in exposure to employment opportunities, education, and evolving labor market demands. While younger cohorts may benefit from better education, they may also face rising competition, automation, and shifting skill requirements (Marx & Nolan, 2014). Public policies, social programs, and intergenerational transfers also influence cohort outcomes (Marx & Nolan, 2014).

3. MATERIALS AND METHODS

This study employs an Age-Period-Cohort (APC) analysis to examine the evolution of in-work poverty in Ecuador. For this purpose, a pseudo-panel is constructed, allowing a group of individuals (cohorts) to be tracked over time

using successive surveys. Cohorts—defined as a group of individuals who share a common characteristic, in this case, year of birth—enable the analysis of their trajectories in the labor market over time (Zalakain, 2023).

Data from the National Survey of Employment, Unemployment, and Underemployment (ENEMDU) —conducted each December by the INEC— will be used for the period from 2007 to 2022. The information collected in December is representative at the national, urban-rural, and provincial levels, ensuring consistency across time. Each year, the survey collects approximately 30,000–91,200 individual observations (INEC, 2022), with a reduction in the sample size observed in 2020.

A harmonization process is conducted for the individual and household databases to ensure consistency and comparability of the data. The study population consists of employed individuals between the ages of 15 and 65 who have at least one job, from whom the tracking cohorts will be constructed.

3.1. Construction of the In-Work Poverty Variable

To construct the in-work poverty variable, the methodologies proposed by Maurizio (2018) and Gammarano (2019) will serve as references. First, individuals classified as employed will be identified based on the criteria established by INEC (2022) and the ILO (2013). These institutions define employed persons as those aged 15 or older who have a job and worked at least one hour during the reference week. Those who were temporarily absent due to shifts, flexible schedules, leaves of absence or other arrangements are also included, even if they did not work during the reference week.

Once the group of workers has been identified, the next step is to determine how many of them live in households classified as poor. According to Jürgen and Lohmann (2008), Filandri and Struffolino (2019), Maurizio (2018), and Gammarano (2019), well-being is assessed at the household level; therefore, poverty is calculated based on per capita labor income and total household income, compared to the established poverty line. Maurizio (2018) argues that the absolute approach is the most appropriate criterion for defining the poverty line in Latin America, as there is substantial evidence that a significant portion of the population still lacks the resources necessary to meet their basic needs.

In Ecuador, the official poverty line is established by INEC based on the cost of a nationally defined basic consumption basket that reflects essential goods required to meet minimum living standards (Espinosa & Mendieta, 2017).

Two variants of the in-work poverty rate will be constructed: In-Work Poverty-All Income Sources (IWPT) and In-Work Poverty-Labor Income Only (IWPWT). The first includes all household income, while the second considers only labor income. Since the unit of analysis is the cohort, the study population will be limited to workers in poor households with only one employed

member. This methodological decision prevents distortions in the measurement of in-work poverty that may arise from income pooling in households with multiple earners, ensuring a more accurate analysis of its dynamics across the life cycle and between generations.

3.2. Study Variables

The set of variables presented in Table 2 is used to estimate the APC model. A detailed description of the variables included in this group is provided below:

Table 2. Variables Used in the APC Model.

Variable	Description	Unit of Measurement
In-Work Poverty Rate-All Income Sources (IWPT)	Calculates the percentage of the working poor, considering total household income (including bonuses, remittances, and rental income).	Proportion
In-Work Poverty Rate–Labor Income Only (IWPWT)	Measures the percentage of the working poor, considering only one household labor income.	Proportion
Age	15-65 years	Years
Period	2007-2022	Years
Cohort	1947-1992	Years

Elaborated by the authors

Since workers' characteristics are also crucial for explaining in-work poverty, the following section provides details on these additional socioeconomic variables:

Table 3. Additional Socioeconomic Variables

Variable	Description
Woman	1: If the worker is female 0: If the worker is male.
Rural	1: If the worker lives in rural area. 0: If the worker lives in urban area.
Coastal region	1: If the worker lives in the coastal region. 0: Any other case
Sierra region	1: If the worker lives in the Sierra region. 0: Any other case
Married	1: If the worker is married. 0: Otherwise.
Education	Years of schooling.
Informal ¹	1: If the worker is informal 0: If the worker is formal
Industry	Agriculture Services Commerce Industry (manufacturing and construction)
Firm Size	1: Firms with more than 100 employees. 0: Firms with 100 or fewer employees.
Household Dependency Ratio	Proportion of economically dependent household members (study and do not work).
Household Workers Ratio	Proportion of employed members in the household.
Minimum Wage	Log difference between minimum and provincial median wage

Elaborated by the authors

3.3. Construction of the APC Model

The APC model is based on the construction of a pseudo-panel, which tracks cohorts of individuals born in the same year across successive surveys. Unlike cross-sectional or short-term panel data, pseudo panels offer the advantage of

¹ Informal employment is defined as any paid work that is not registered, regulated, or protected by legal or regulatory frameworks (Husmanns, 2004), including informal wage earners and self-employed workers.

capturing labor market dynamics over time. Key labor indicators are shaped by both age-related life-cycle effects and generational influences, which evolve over time. When life-cycle profiles are estimated using cross-sectional data, these effects are confounded, as a single-time observation cannot disentangle age from cohort influences (Deaton, 2018). While pseudo-panels do not track the same individuals over time, they mitigate the attrition typical of panel data by constructing cohorts from independent cross-sectional survey samples each year. This approach is particularly valuable for extending the period of analysis and identifying long-term structural trends in labor market behavior.

It is important to note that this analysis combines a pseudo-panel construction with an Age-Period-Cohort (APC) framework. Cohorts, defined by fixed characteristics such as year of birth, are tracked over time using repeated cross-sectional surveys, approximating longitudinal data (Deaton, 1985). The pseudo-panel provides the structured dataset necessary to implement the APC model, which decomposes in-work poverty dynamics into age, period, and cohort effects, allowing a clear interpretation of life-cycle patterns, generational differences, and macroeconomic influences (Deaton & Paxson, 1994).

Following the linear decomposition framework proposed by Deaton (2018), and Deaton and Paxson (1994), this study distinguishes the effects of the life cycle, generational change, and economic cycles. This methodology considers three matrices of variables: A for age, C for cohort, and P for period. The data are structured so that each observation represents a cohort j in a specific year t . In this setup, the rows of matrices A , C , and P consist of cohort-year pairs, and the number of columns corresponds to the number of ages, cohorts, and periods, respectively. The decomposition of the dependent variable is expressed as follows:

$$y_{jt} = \beta \iota_N + A_{jt}\sigma + C_j\delta + P_t\theta + X_{jt}\gamma + u_{jt} \quad (1)$$

Where y_{jt} represents the dependent variable for cohort j in period t , arranged in $N \times 1$ vector; ι_N is an $N \times 1$ vector of ones associated with the constant parameter β ; and u_{jt} is a vector of error terms for cohort j in period t . The vectors σ , δ , and θ correspond to the effects associated with age, cohort, and period, respectively, while X_{jt} includes a complete set of additional explanatory variables for cohort j in period t .

The literature indicates that, in this type of analysis, one of the variables related to age, period, or cohort must be excluded to avoid singularity in the regression matrix. This is due to the identification challenge posed by the relationship among these variables (cohort = year – age). To address this issue, we follow the constrained generalized linear model proposed by Deaton and Paxson (1994), which resolves the age-period-cohort (APC) identification problem through explicit orthogonality and zero-sum constraints on period effects. This strategy has been applied to estimate age-period-cohort effects for economic phenomena in previous studies (Amber & Chichaibelu, 2023;

Balleer et al., 2009; Duval Hernández & Orraca Romano, 2011; Fredes, 2021; Ontaneda et al., 2022). Specifically, an additional constraint is introduced: the period effects are assumed to be orthogonal to a time trend and are constrained to sum to zero, as follows:

$$\begin{aligned}\kappa'\theta &= 0 \\ \iota_T'\theta &= 0\end{aligned}\tag{2}$$

Here, κ is a vector $(1, 2, 3, \dots, T)$, where $\kappa = 1$ represents the initial period and $\kappa = T$ the final period. One approach to estimating Equation 1 subject to the constraint 2 is to define period dummy variables for $t = 3, \dots, T$ as follows:

$$d_t^* = d_t - [(t - 1)d_2 - (t - 2)d_1]\tag{3}$$

Where $d_t = 1$ if the period is t , and 0 otherwise. This equation ensures that Equation 2—which requires the period variables to sum to zero—is satisfied. The values of d_t^* estimate the coefficients from the third to the final period. The coefficients for the first and second periods can be recovered based on the condition that all period effects sum to zero and thus satisfy the restriction imposed by Equation 2. This structure allows period effects to be interpreted as deviations from a neutral time trend, enabling a coherent reading of temporal shocks. The resulting estimates thus reflect substantive economic mechanisms, reinforcing the theoretical and empirical validity of the identification strategy.

In the estimation of Equation 1, the first age group and the forty-fifth cohort are omitted, so that individuals aged 15 and working poor individuals who were 15 years old in 2007 (the 1992 cohort) serve as the reference groups. As for the period, timeless average of all years as a reference point is used, following the methodology proposed by Deaton and Paxson (1994). The estimation employs the errors-in-variables estimator for grouped data, as proposed by Deaton (2018). In this way, the model uses individual-level data to calculate the sampling error variances required to correct for bias and obtain a consistent estimator. All estimates were obtained using the survey weights provided.

The in-work poverty variables are expressed as proportions, calculated as the number of working poor individuals within a given cohort divided by the total number of workers in that cohort. This approach ensures that the rate remains within a range of zero to one and allows for the tracking of cohorts over time.

4. RESULTS AND LIMITATIONS

4.1. Descriptive Statistics: In-Work Poverty by Age, Period, and Cohort

The evolution of the in-work poverty rate follows similar patterns in both variations. However, the IWPWT (In-Work Poverty-Labor Income Only) remains, on average, 5,35 percentage points higher than the IWPT (In-Work Poverty-All Income Sources) throughout the 2007–2022 period. The years 2009 and 2020 recorded the highest in-work poverty rates, reaching 28,73 % and 27,18 % for IWPT, and 33,01 % and 34,31 % without them, respectively.

With respect to the life cycle, distinct behavioral patterns can be identified. At the beginning of working life, the share of working poor is high—at age 15, the IWPT is 51,59 % and the IWPWT is 56,50 %. However, both rates gradually decline until age 25. During middle age, the rates gradually increase until age 40, then decrease until age 59, and rise slightly again by age 65.

In terms of cohort analysis, a clear generational effect is observed in the evolution of in-work poverty. Older generations, such as the 1947 cohort, exhibited a declining trend in in-work poverty up to approximately the 1957 cohort. From that point onward, the rate showed a slight upward trend until the 1980 cohorts. However, from that point to the most recent generation (1992 cohort), a sustained decrease in in-work poverty is observed. In this cohort, the IWPT stands at 19,73 %, while the IWPWT reaches 23,79 % (see Appendix B).

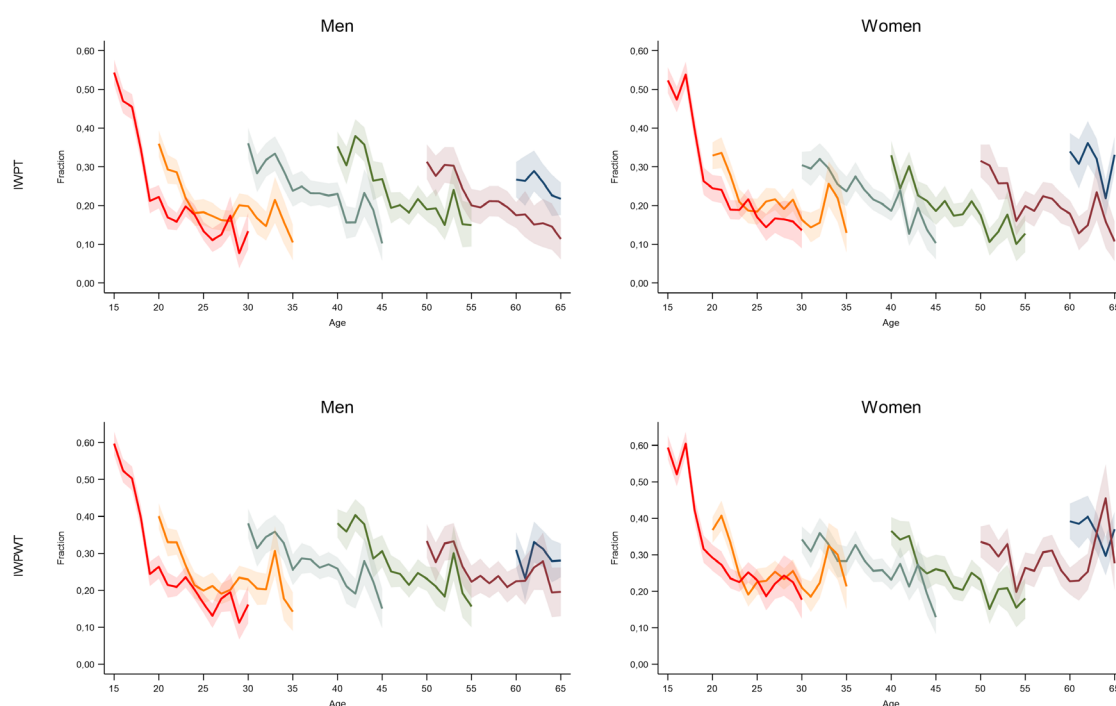
4.2. Socioeconomic Characteristics of the Working Poor

The figures below illustrate the evolution of the in-work poverty rate by birth cohort, presented in its two forms: In-Work Poverty-All Income Sources (IWPT) and In-Work Poverty-Labor Income Only (IWPWT), across different categories. Each line connects data points for the same cohort over time, while different cohorts remain unconnected. For example, individuals who were 20 years old in 2007 are followed annually from the initial observation in 2007 until they reach age 30 in 2022, based on data from successive survey rounds. While the decomposition relies on data from all cohorts born between 1947 and 1992, the figures display only six representative cohorts, spaced at ten-year intervals, for ease of interpretation.

Figure 1 shows the in-work poverty profiles disaggregated by gender (men and women). Overall, the cohort profiles exhibit a slightly decreasing trend. The graphs also provide insights into cohort patterns, indicating that more recent generations—both male and female—tend to experience lower levels of in-work poverty over time. By following each connected line, which represents the same cohort tracked over 16 years, the figure reflects the impact

of major economic events. For instance, both in-work poverty rates show a significant increase during critical periods such as 2009 and 2020.

Figure 1. Evolution of In-Work Poverty Cohorts — In-Work Poverty (IWPT and IWPWT), by Gender



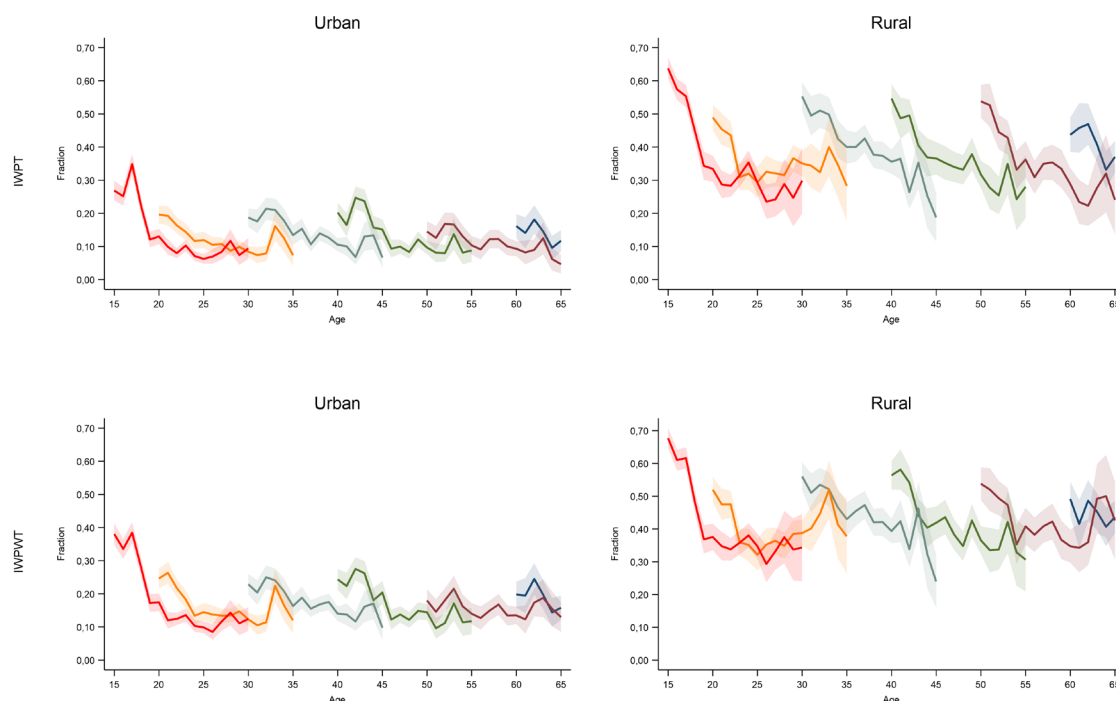
Note: Shaded areas represent 95 % confidence intervals.

Source: ENEMDU, 2007-2022

Elaborated by the authors

Figure 2 illustrates the age profiles of in-work poverty for urban and rural areas, distinguishing between the IWPT and IWPWT measures. In both cases, the profiles exhibit a declining pattern with age, suggesting that the likelihood of being in working poverty decreases as individuals advance in their life cycle. In urban areas, both indicators show substantial variation across cohorts, allowing the identification of cohort effects at specific ages. For instance, the IWPT and IWPWT levels for the 1987 cohort are 11,64 and 11,43 percentage points lower, respectively, than those observed for the cohort born ten years earlier at the same age. A similar downward trend is observed in rural areas, although at higher overall levels of in-work poverty. In this case, the cohort effects are more pronounced: the IWPT and IWPWT for the 1987 cohort are 22,38 and 18,45 percentage points lower, respectively, than those for the cohort born a decade earlier at the same age.

Figure 2. Evolution of In-Work Poverty Cohorts In-Work Poverty – IWPT and IWPWT, by Area



Note: Shaded areas represent 95 % confidence intervals.

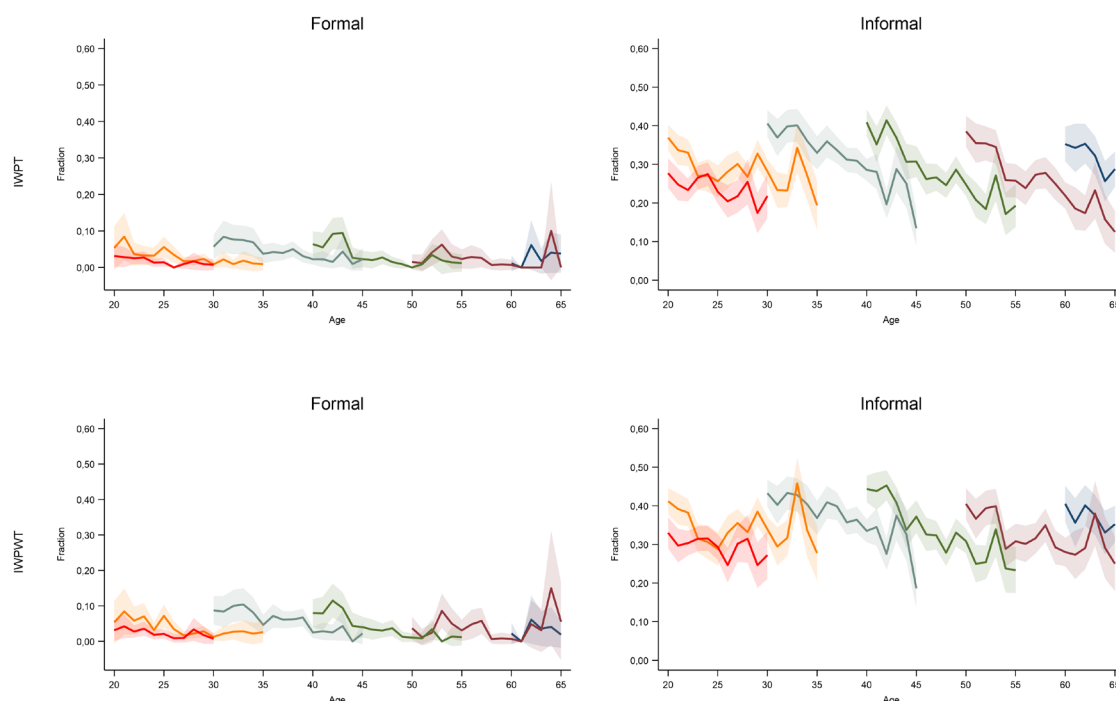
Source: ENEMDU, 2007-2022

Elaborated by the authors

Figure 3 provides a comprehensive view of the age profiles of in-work poverty across formal and informal employment, using both IWPT and IWPWT indicators. In the formal sector, the in-work poverty rate remains consistently low throughout the life cycle. Differences between cohorts are relatively minor, which suggests that formal employment offers greater income stability and protection against economic fluctuations. This stability reflects the role of formal jobs in mitigating vulnerability to in-work poverty.

In contrast, the informal sector exhibits markedly higher levels of in-work poverty and greater variability across cohorts. The profiles show wider fluctuations over time, indicating that informal workers are more exposed to economic shocks and labor market instability. These cohort differences highlight that unstable earnings amplify vulnerability to poverty throughout the life cycle.

Figure 3. Evolution of In-Work Poverty Cohorts In-Work Poverty – IWPT and IWPWT, by Employment Sector



Note: Shaded areas represent 95 % confidence intervals.

Source: ENEMDU, 2007-2022

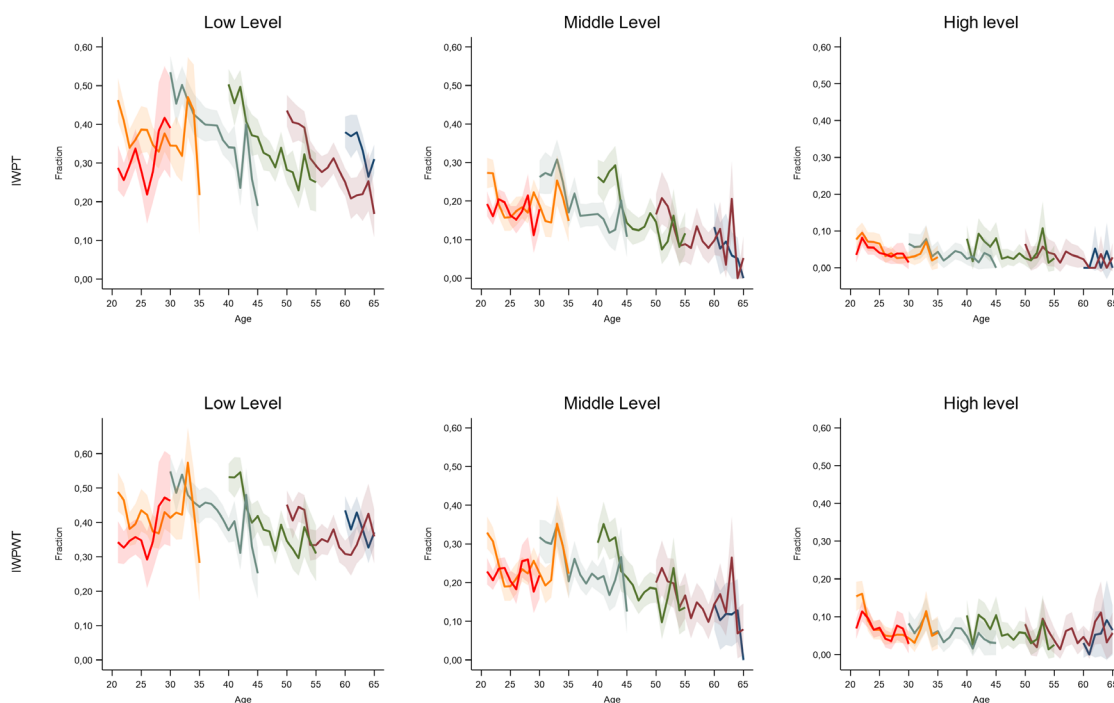
Elaborated by the authors

Figure 4 shows the evolution of the in-work poverty rate across three educational levels: low, medium, and higher. Among individuals with low education, both variants of the in-work poverty rate decline with age; however, they remain elevated throughout the life cycle compared to other education groups and exhibit greater volatility. For example, the average IWPT and IWPWT for a 24-year-old are 35,68 % and 42,14 %, respectively, while at age 65 the corresponding rates fall to 28,99 % and 39 %.

For individuals with medium education, the in-work poverty rate displays evidence of cohort effects at specific ages, with younger cohorts showing lower poverty rates than older cohorts at the same stage of the life cycle. For instance, at age 25, the 1992 cohort records an IWPT that is 8,9 percentage points lower and an IWPWT that is 6,41 percentage points lower than those of the cohort born five years earlier.

Among individuals with higher education, in-work poverty rates in both variants are the lowest. The trend remains relatively stable over the life cycle, with a slight decline as age increases. On average, at age 24, the IWPT and IWPWT are 4,4 % and 8 %, respectively, decreasing to 1,91 % and 7 % by age 65. Cohort differences are minimal, suggesting that access to higher education continues to confer substantial economic stability and protection against in-work poverty.

Figure 4. Evolution of In-Work Poverty Cohorts In-Work Poverty – IWPT and IWPWT, by Education Level



Note: Shaded areas represent 95 % confidence intervals.

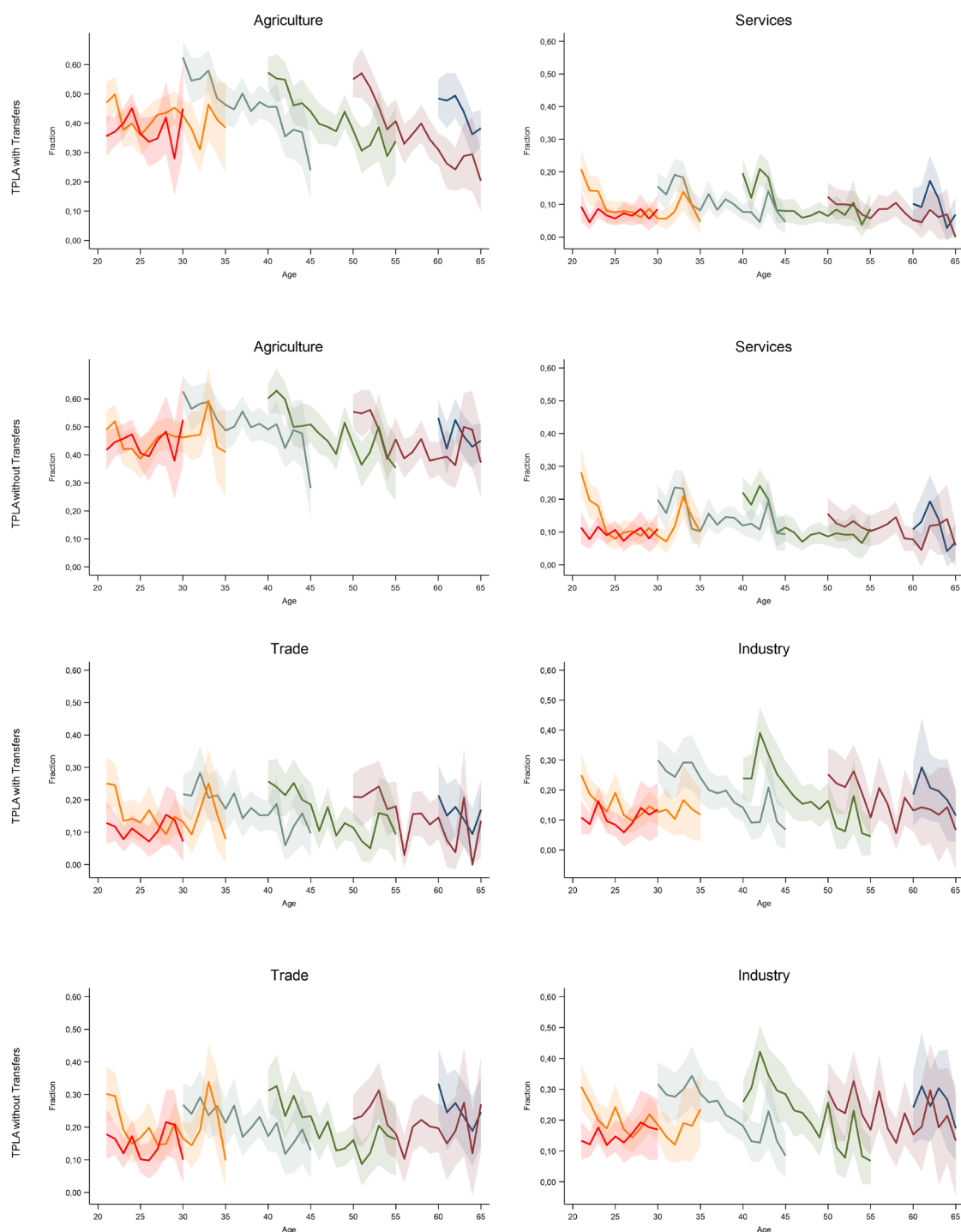
Source: ENEMDU, 2007-2022

Elaborated by the authors

Figure 5 presents the age profiles of the in-work poverty rate across major sectors of economic activity. In agriculture and mining, both IWPT and IWPWT steadily decline with age but remain high even at older ages. For instance, in agriculture, the IWPT and IWPWT are 62,64 % and 66,55 % at age 15, falling to 38,65 % and 49,52 % at age 65.

In the services sector, in-work poverty rates follow a downward trajectory across cohorts, with notable differences at specific ages. At age 20, the 1992 cohort shows IWPT and IWPWT values that are 11 and 13 percentage points lower, respectively, than those of the cohort born five years earlier. Similar declining patterns appear in commerce and industry. In commerce, the IWPT and IWPWT drop from 31,15 % and 36,99 % at age 15 to 14,43 % and 25,61 % at age 65. In industry, the corresponding rates decrease from 29,81 % and 36,40 % to 10,18 % and 18,77 %, respectively. Comparing sectors, services consistently exhibit the lowest in-work poverty rates, while agriculture records the highest levels throughout the life cycle, highlighting the persistent structural disadvantages of rural and primary activities.

Figure 5. Evolution of In-Work Poverty Cohorts In-Work Poverty – IWPT and IWPWT, by Sector of Economic Activity



Note: Shaded areas represent 95 % confidence intervals.

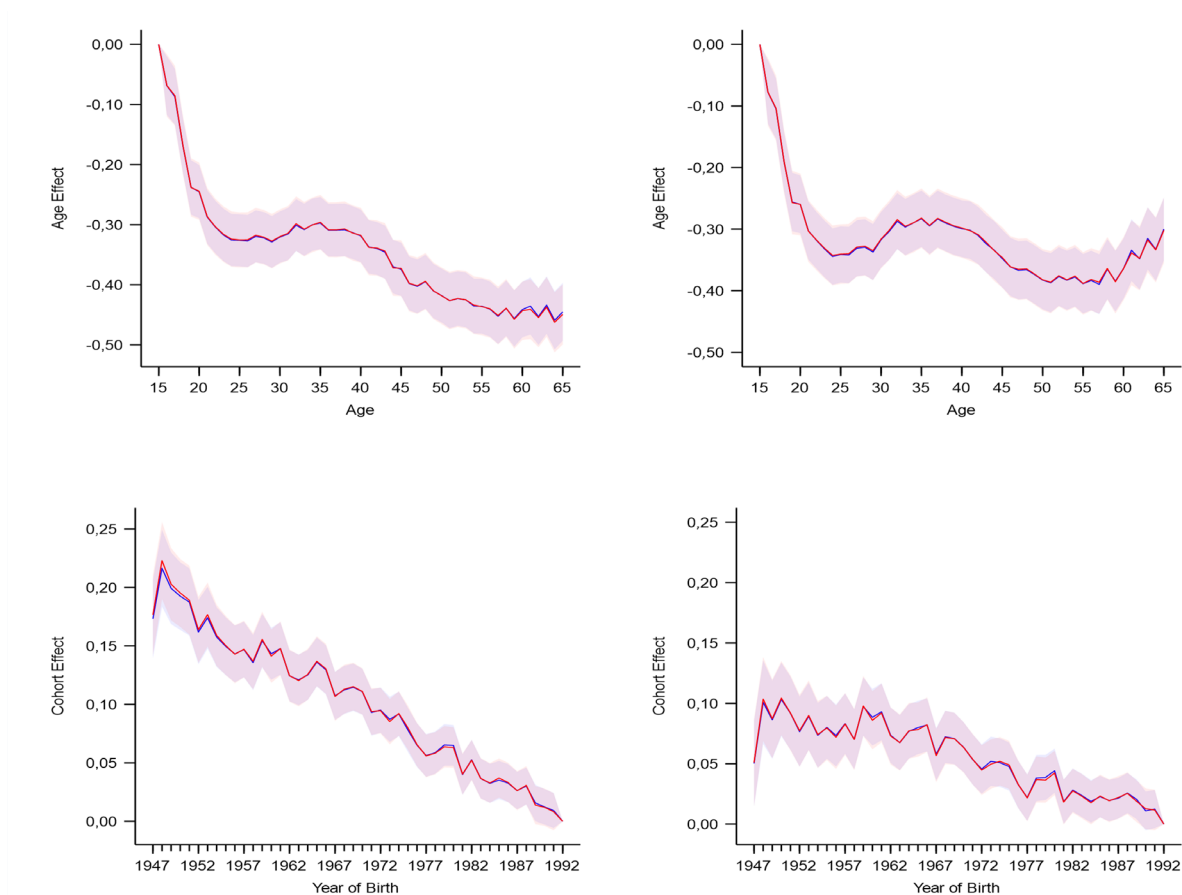
Source: ENEMDU, 2007-2022

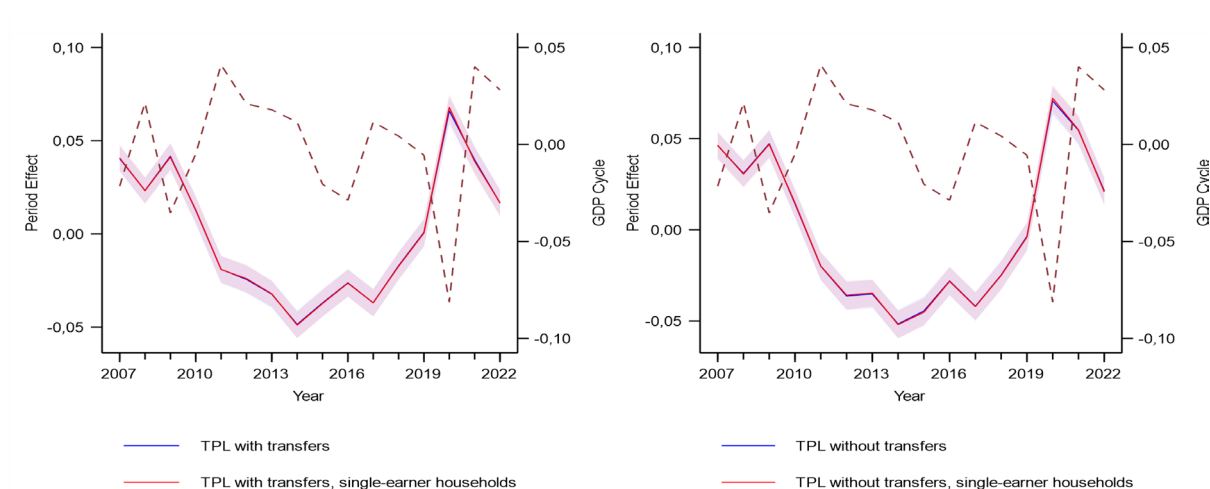
Elaborated by the authors

4.3. APC Model Estimates

Figure 6 presents the estimated coefficients of the model for 46 cohorts, 51 age groups, and 16 years, along with their 95 % confidence intervals. The graph shows the effects of age, period, and cohort for both the total sample of households and households with a single worker. The estimated coefficients do not reveal significant differences between the two groups. Moreover, the global significance test—whose results are detailed in Appendix C—indicates that the age, period, and cohort coefficients are statistically significant and different from zero in both models, thereby allowing the results to be generalized to the entire population of households under study.

Figure 6. Decomposition of Age, Cohort, and Period Effects IWPT (Left Panel) and IWPWT (Right Panel)





Note: Lines show APC model coefficients with 95 % confidence intervals (shaded). Estimates for 2007–2008 are based on Equation 2 restrictions. The dashed line represents the cyclical component of real GDP, estimated using the Hodrick-Prescott filter and displayed on the secondary axis.

Source: ENEMDU, 2007–2022

Elaborated by the authors

The first panel of Figure 6 shows the effects of age on variations in the in-work poverty rate (IWPR) for households with a single worker, using the situation at age 15 as the reference point while holding constant the effects of the economic cycle and cohort. In both IWPT and IWPWT variants, a significant decline is observed between ages 15 and 25, reflecting improved economic conditions during the initial years of labor market entry. However, beginning at age 25, in-work poverty starts to rise again, peaking around age 35. After that, the IWPT shows a slight decline, while the IWPWT continues to increase toward the end of the life cycle. In old age, transfers help reduce in-work poverty, but their absence—combined with retirement—intensifies economic vulnerability. These findings are consistent with Rowntree (1902), who identified three stages of heightened economic hardship across the life cycle: youth, adulthood with family responsibilities, and old age after retirement. Additionally, Tejero (2017) notes that workers in the middle stages of their life cycle are more likely to experience in-work poverty.

The second panel of Figure 6 shows the generational effects on the in-work poverty rate (IWPR), using the 1992 cohort as the reference group while holding constant the effects of the life cycle and the economic cycle. In both variants, in-work poverty is higher among older generations, suggesting that at the same age, younger cohorts experience lower levels of in-work poverty. However, these results contrast with the findings of Fredes (2021) for Chile, who argues that more recent cohorts do not face a lower risk of in-work poverty; on the contrary, they are more likely to experience it compared to their immediate predecessors.

These cohort results reinforce the importance of situating Ecuador within the broader international debate. While Fredes (2021) finds that younger cohorts in Chile face higher risks of in-work poverty despite higher education levels, our results suggest the opposite pattern for Ecuador, where more recent generations experience lower levels of in-work poverty at the same age. Similarly, Broström and Jansson (2022) show that in Sweden, long-term reductions in in-work poverty are shaped not only by generational change but also by macroeconomic cycles and institutional reforms. Taken together, these studies highlight that the Ecuadorian case aligns with evidence of structural improvements across cohorts but also underscores the role of national contexts in shaping whether younger generations face advantages or disadvantages in the labor market.

The third panel of Figure 6 shows the effect of the economic cycle on the in-work poverty rate (IWPR), alongside the cyclical component of Ecuador's real GDP, while holding constant the effects of the life cycle and generational change. A countercyclical pattern emerges, in which the IWPR decreases during periods of economic growth and rises during recessions—such as in 2009, 2016, and 2020—linked to the global financial crisis, the decline in oil prices, and the COVID-19 pandemic respectively. This pattern aligns with pro-poor economic growth theory, which suggests that economic expansions tend to benefit the most vulnerable groups, thereby reducing in-work poverty.

4.3.1. Decomposition of the Age Effect on the In-Work Poverty Rate, by Various Categories

The first panel of Figure 7 shows the age effects on the in-work poverty rate (IWPR) by gender, while isolating generational variations and macroeconomic shocks. The IWPT declines rapidly until age 25 for both men and women. Between ages 26 and 40, it remains relatively stable for men, while it increases slightly for women until age 36. From age 41 for men and age 37 for women, the IWPT begins to decrease again, reaching its lowest point at age 65. For men, the IWPWT shows a sharp decline up to age 25, stabilizing between ages 26 and 40, and then gradually declines into old age. In contrast, the IWPWT for women follows a different trajectory: after falling until age 25, in-work poverty rises until age 43, decreases until age 55, and then increases again in the final stage of the life cycle, reflecting greater vulnerability in old age. The reduction in in-work poverty is more pronounced among men, suggesting the existence of a gender gap. These findings are consistent with Van Winkle and Struffolino (2018), who argue that over the life course, the risk of in-work poverty decreases with age among men, while it tends to increase among women. Additionally, Filandri and Struffolino (2019) explain that women are more likely to experience in-work poverty due to their concentration in low-paid jobs and the persistent gender wage gap.

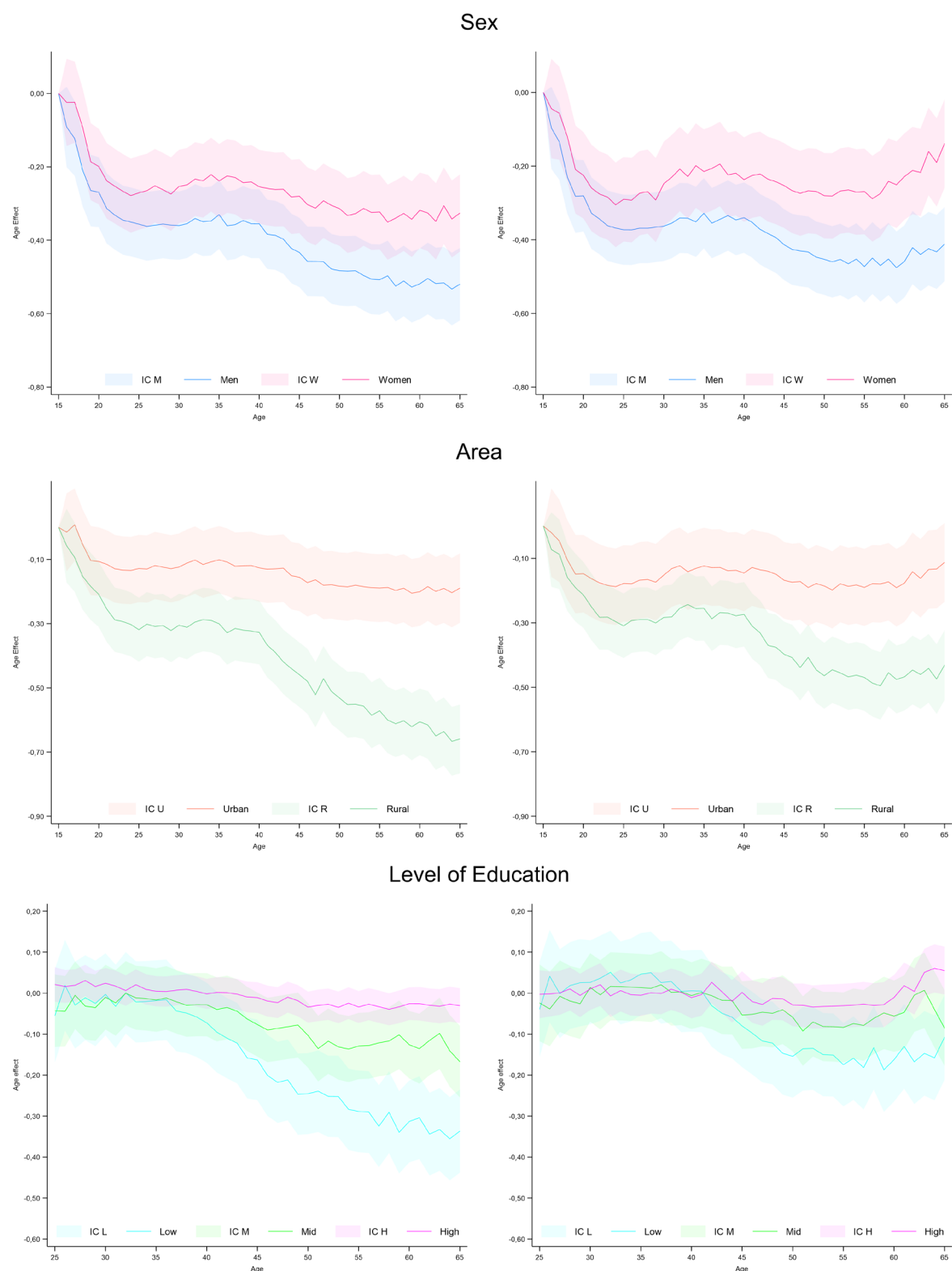
The second panel of Figure 7 presents the age effects by area, controlling for generational variations and the economic cycle. In urban areas, the IWPT declines until age 20, remains relatively stable between ages 21 and 40, and then progressively decreases until age 65. In rural areas, the initial decline extends until age 25, followed by a period of stability between ages 26 and 40, and then a more pronounced decrease toward the end of the life course. Regarding the IWPWT, in urban areas it decreases until age 29, shows a slight increase between ages 30 and 43, and then progressively declines until age 60, followed by a slight rise around age 65. In rural areas, the IWPWT also decreases in the early stages up to age 25, but unlike in urban areas, it shows a more pronounced increase between ages 26 and 40. Afterwards, it experiences a sustained decline until age 56, followed by a modest increase toward the end of the life course. These findings are consistent with the work of Peña (1975), who argues that in rural areas, due to limited access to formal education and more specialized jobs, workers rely more heavily on accumulated experience, which yields increasing returns over time. In contrast, in urban areas, access to educational and specialized employment opportunities lessens the effect of accumulated experience. Furthermore, high competition and the demands of the formal labor market contribute to the persistence of in-work poverty, limiting its reduction throughout the life course (World Bank, 2013).

The third panel of Figure 7 shows the age effects on the in-work poverty rate (IWPR) by education level, using age 25 as the reference point. Among workers with a low level of education, the IWPT increases slightly until age 36, likely due to the prevalence of low-quality jobs with limited social protection. From age 37 onward, the rate gradually declines through the end of the life course, consistent with Mincer's (1974) human capital theory, which suggests that work experience can partially compensate for the lack of formal education. Meanwhile, for workers with a medium level of education, the IWPT follows a similar pattern, although the decline after age 37 is less pronounced. Among those with higher education, the IWPT steadily decreases throughout the life course, indicating lower exposure to in-work poverty at all ages. On the other hand, for workers with low educational attainment, the IWPWT increases until age 39 and then progressively declines into old age. Among those with a medium level of education, the pattern is similar, but the decline continues until age 59 before rising slightly by age 65. In contrast, among workers with higher education, the IWPWT is low and decreases from the outset, reflecting minimal exposure to in-work poverty. This scenario highlights that higher education facilitates better integration into the labor market and enables individuals to achieve higher earnings from an early age, thereby reducing the risk of poverty (Lohmann, 2008). However, its effect on income growth over the life course appears limited, which may be explained by increased labor market competition and overeducation—factors identified by Lustig et al. (2013) as key determinants of wage inequality.

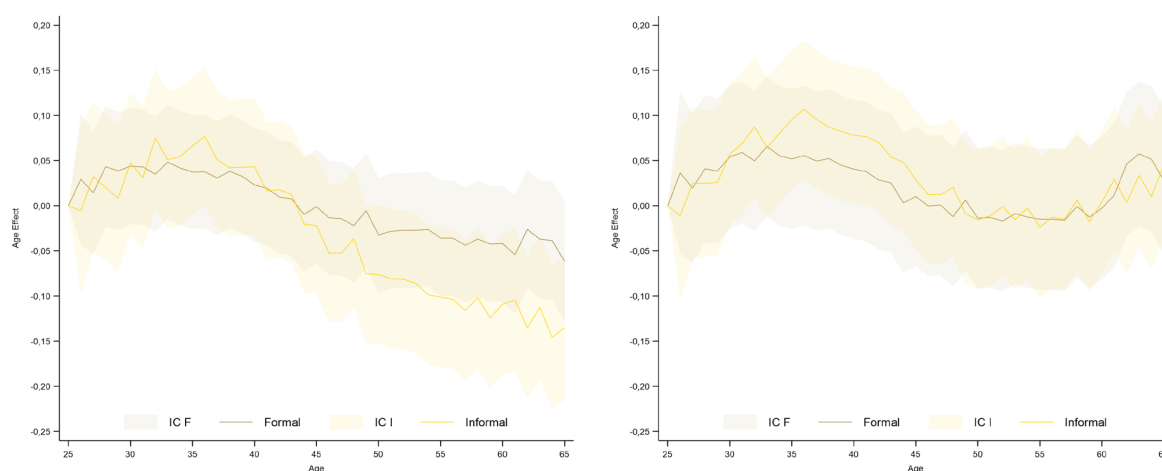
The fourth panel of Figure 7 shows how the in-work poverty rate (IWPR) varies over the life course according to the type of employment. The IWPT follows a similar pattern in both sectors, increasing until age 30 in the formal sector and until age 36 in the informal sector, then steadily declining until age 65. Regarding the IWPWT, the rate follows a similar trajectory in both types of employment, increasing until age 33 in the formal sector and age 36 in the informal sector. It then steadily declines until age 48, at which point it stabilizes and remains at similar levels in both sectors until age 60. Toward the end of the working life, it rises slightly again, which may be associated with job deterioration at older ages. This pattern indicates that vulnerability is greatest during the middle stages of working life, reflecting problems related to job quality and income levels (Gammarano, 2019). It also shows that informal workers not only earn less but also work fewer hours (Maurizio, 2021).

The fifth and sixth panels of Figure 7 show the effect of age on the in-work poverty rate across different sectors of economic activity, independent of cohort and period, allowing for the identification of patterns over the life course. In the agricultural sector, the IWPT increases until age 37 and then decreases until age 65. In the services sector, the IWPT remains stable until age 37, then gradually declines until age 60, followed by a slight increase up to age 65. In the commerce sector, the IWPT is constant until age 39 and begins to decline from age of 40 until the age of 65. In the industrial sector, the IWPT remains stable until age 36 and then progressively decreases. Regarding the IWPWT, in the agricultural sector it increases until age 40 and then gradually decreases. In the services sector, the age effect remains stable until age 38, followed by a steady decline until age 59 and a small increase toward the end of the working life. In the commerce and industrial sectors, the IWPWT shows a slight increase until ages 39 and 35, respectively, and then decreases until age 65, with the decline being more pronounced in the industrial sector. Overall, in nearly all sectors, in-work poverty tends to be higher during the middle stages of working life and decreases as workers gain experience and job stability. The agricultural sector stands out, where the decline in in-work poverty with age is more pronounced. This suggests that the accumulation of experience allows workers to access better working conditions and higher earnings, thereby reducing in-work poverty (Gollin et al., 2014). Moreover, Ahmad (2009) highlights that support networks improve access to key resources such as agricultural inputs and technical assistance, which enhance economic stability and reduce vulnerability to in-work poverty. FAO (2015) also emphasizes that support policies for small-scale farmers—such as financing and market access—are essential for improving productivity and rural incomes, helping to reduce in-work poverty, especially at older ages.

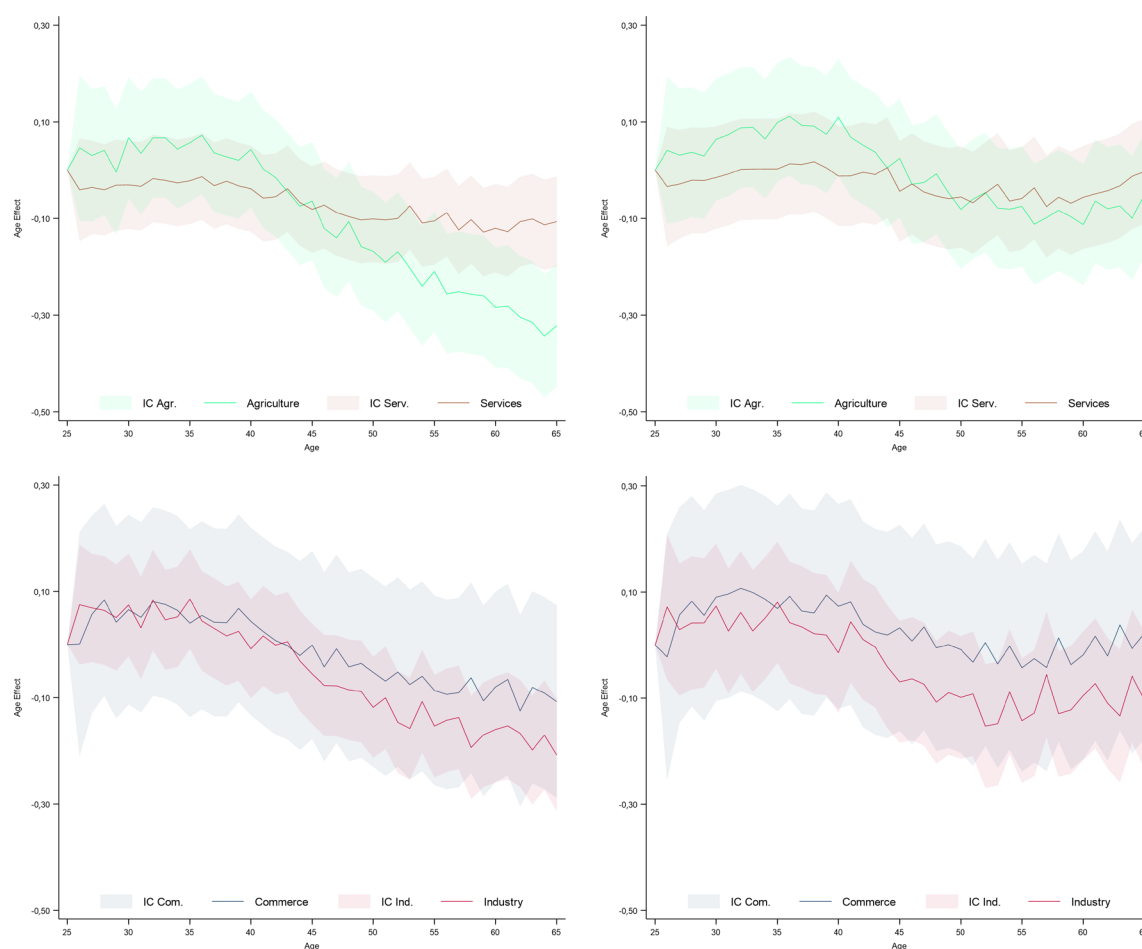
Figure 7. Decomposition of the Age Effect on the In-Work Poverty Rate for Single-Worker Households, by Various Categories. In-Work Poverty—All Income Sources (Left Panel) and In-Work Poverty—Labor Income Only (Right Panel)



Employment Sector



Industry Sector



Note: Lines represent estimated age effects by category, with shaded areas indicating 95 % confidence intervals. The reference age is 15 for gender and area, and 25 for employment sector, education level, and area categories and sector of economic activity.

Source: ENEMDU, 2007-2022

Elaborated by the authors

4.3.2. Decomposition of the Cohort Effect on the In-Work Poverty Rate, by Various Categories

The first panel of Figure 8 shows the generational effects on the in-work poverty rate (IWPR) by gender, controlling for age and period. For the IWPT, both men and women display stronger cohort effects among older generations, indicating that younger cohorts experience lower levels of in-work poverty than their predecessors at the same age. Regarding the IWPWT, men exhibit a declining trend, with lower levels of in-work poverty in the younger cohorts. In contrast, among women, the IWPWT remains relatively stable across generations, with minimal variation between cohorts. These findings suggest that in-work poverty has affected older generations of men more than women. This phenomenon may be explained by the fact that in earlier generations, men had significantly higher participation in the labor market. Social and cultural norms of the time assigned women the primary role of household caretakers and child-rearers, which limited their access to formal employment and labor market integration (Cabrera & Gamboa, 2022). This division of roles may have contributed to a more pronounced incidence of in-work poverty among men in those generations. Moreover, the fact that more recent generations—both men and women—face lower levels of in-work poverty compared to their predecessors could be attributed to greater access to education. A higher level of educational attainment has facilitated social mobility, providing newer generations with better employment opportunities and, consequently, greater economic stability (INEC, 2024).

The second panel of Figure 8 shows generational changes in the in-work poverty rate (IWPR) for urban and rural areas, independent of age and period effects. In the case of the IWPT, both urban and rural areas exhibit a declining trend, indicating that the cohort effect is lower for younger generations, who experience lower in-work poverty rates than their predecessors at the same age. As for the IWPWT, it remains relatively constant across generations in urban areas. In contrast, in rural areas, the IWPWT shows a declining cohort effect—that is, more recent cohorts experience lower levels of in-work poverty at the same age compared to older rural generations. These findings indicate that the cohort effect is more pronounced in rural areas, suggesting that older generations in these regions faced higher levels of in-work poverty than their urban counterparts. This may be explained by limited access to education, a reliance on traditional agriculture, and a lack of productive diversification among older rural cohorts (FAO, 2015). By contrast, in recent decades, agricultural sector policies and support programs have improved the labor and economic conditions of younger rural generations (Ahmad, 2009).

Generational trends across different levels of education are presented in the third panel of Figure 8. The cohort effect on the IWPT for workers with low educational attainment is decreasing, meaning that younger cohorts experience lower levels of in-work poverty than their predecessors at the same

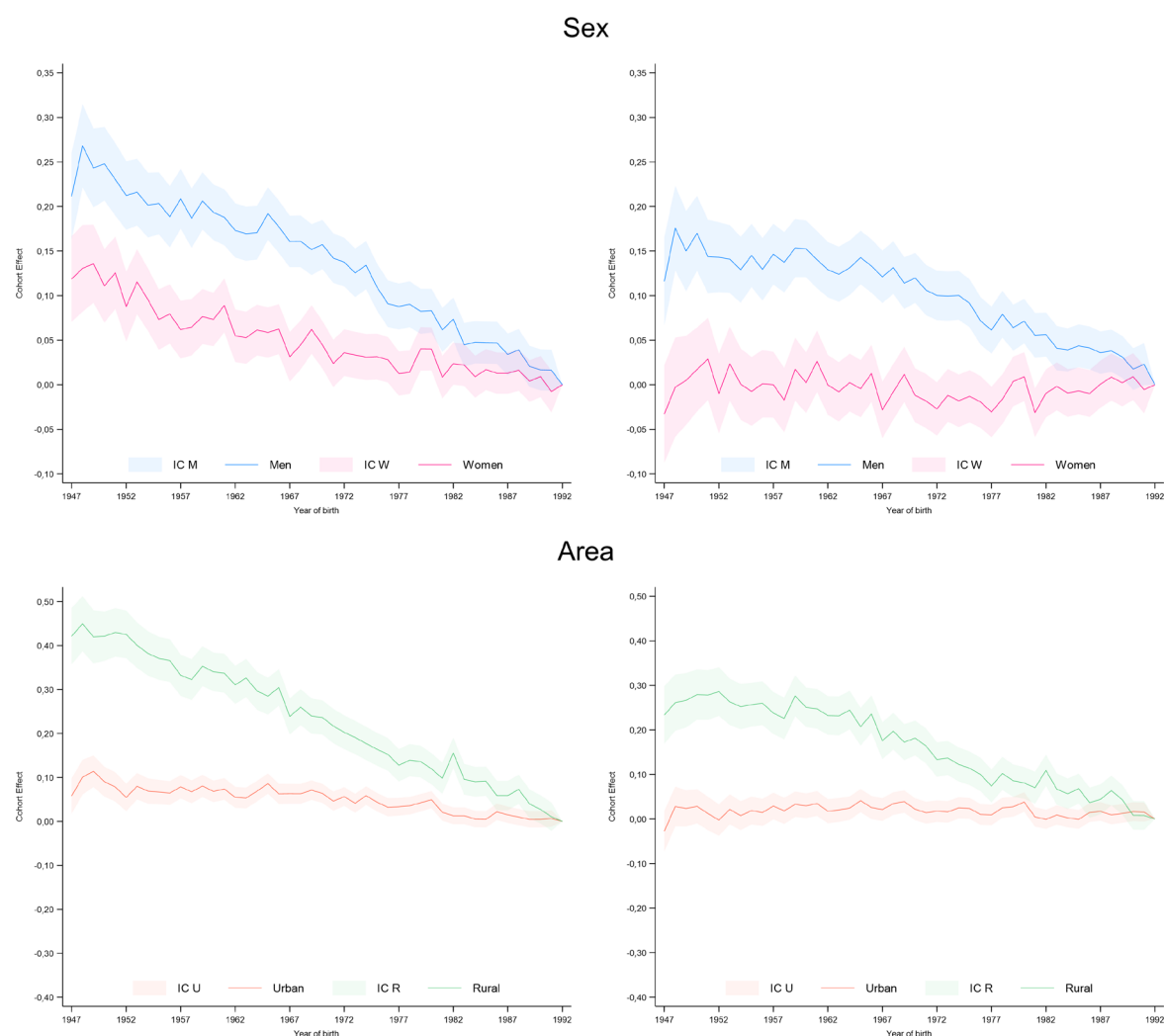
age. In contrast, for workers with medium and higher levels of education, the cohort effect on the IWPT remains relatively stable across generations, with slight reductions among younger cohorts. Regarding the IWPWT, the cohort effect for workers with low education also shows a downward trend, indicating that younger cohorts face lower levels of in-work poverty than older ones at the same age. For those with medium and higher education, the cohort effect on the IWPWT is smaller among generations born up to 1962, suggesting lower in-work poverty rates in these groups. After that, the effect stabilizes, with subsequent generations showing similar levels of in-work poverty and no significant differences. These findings may be related to the challenges younger generations face in accessing jobs that ensure well-being, despite having greater access to education (Fredes, 2021). This suggests that education—once a reliable path to successful labor market integration—has lost effectiveness. This highlights a contradiction: a younger population that is increasingly educated, yet facing declining prospects for entering a labor market that is increasingly competitive and rigid (Martínez, 2006).

The generational evolution of sectoral participation is presented in the fourth panel of Figure 8. In both the formal and informal sectors, cohort effects on the IWPT decline among younger generations, indicating lower levels of in-work poverty compared to their predecessors. However, older generations in the informal sector exhibit a stronger effect, meaning they were more severely affected by in-work poverty than their counterparts in the formal sector. Nevertheless, this gap has narrowed among younger generations. Regarding the IWPWT, the results show that in the formal sector, the cohort effect increases slightly up to the 1960 cohort and then declines, indicating a reduction in in-work poverty among younger generations. In the informal sector, the effect is slightly decreasing across all cohorts, reflecting lower levels of in-work poverty in more recent generations. This trend may be explained by changes in the productive structure and working conditions across both sectors. In the formal sector—although typically associated with greater stability and benefits—generations born up to 1960 faced low wages due to the country's economic structure at the time, which did not ensure sufficient income to surpass the poverty threshold (Tokman, 2007). In contrast, the reduction in in-work poverty in the informal sector may be attributed to workers' ability to diversify their activities and adjust their income—although this does not imply improvements in job stability or access to social protection.

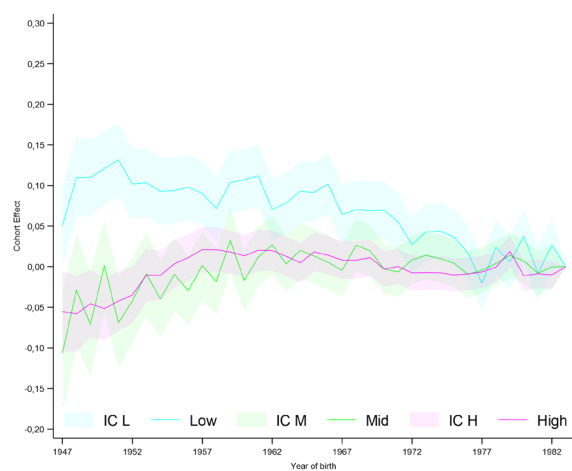
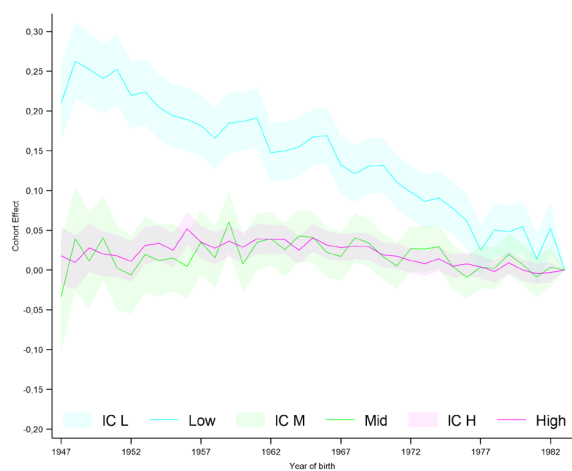
Finally, the generational progression across different economic activities is presented in the fifth panel of Figure 8. The cohort effect on the IWPT shows a declining trend across all economic sectors, indicating higher levels of in-work poverty among older cohorts. When comparing the magnitude of the effect across sectors, it is evident that older generations in the agricultural and industrial sectors experienced higher levels of in-work poverty than their counterparts in the commerce and services sectors. Regarding the IWPWT, the cohort effect also shows a downward trend in the agricultural, industrial,

and commerce sectors, meaning that older cohorts experienced higher levels of in-work poverty than their successors. In the services sector, however, the cohort effect remains constant across generations. This pattern can be explained by a combination of structural factors that have influenced the evolution of employment and in-work poverty in each sector. For example, in the agricultural sector, a strong reliance on traditional farming practices—combined with limited access to technology and adequate infrastructure—restricted employment opportunities and the potential for income growth (FAO, 2015). These structural limitations contributed to higher levels of in-work poverty among older cohorts in the agricultural sector.

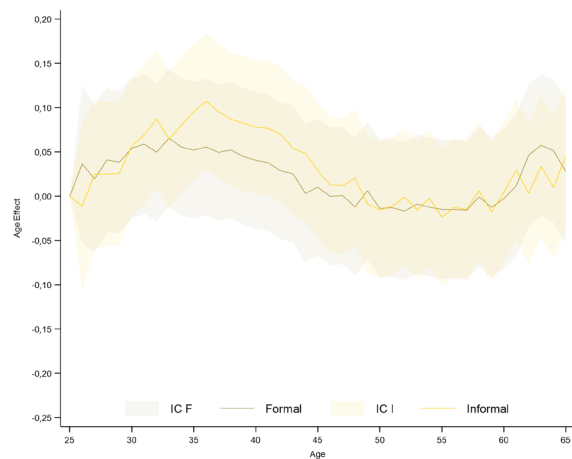
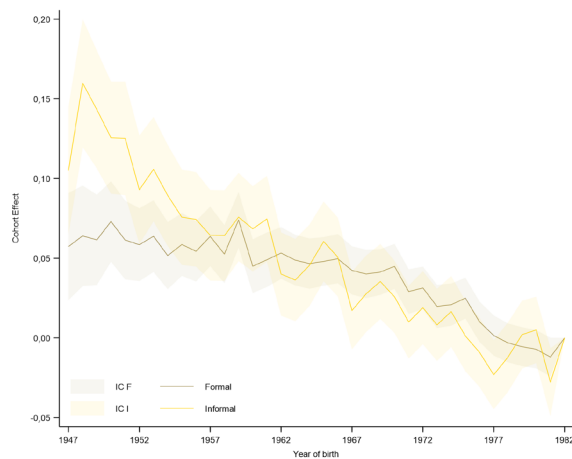
Figure 8. Decomposition of the Cohort Effect on the In-Work Poverty Rate for Single-Worker Households, by Category. In-Work Poverty—All Income Sources (Left Panel) and In-Work Poverty—Labor Income Only (Right Panel)



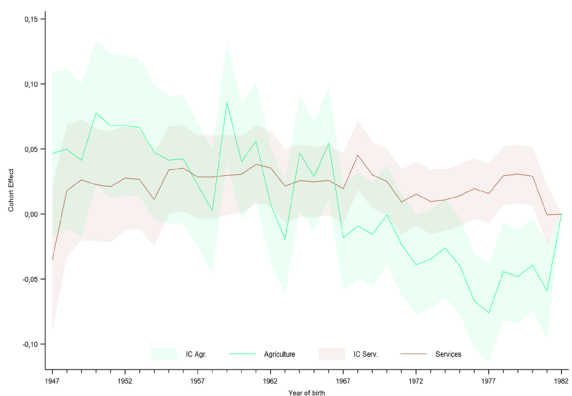
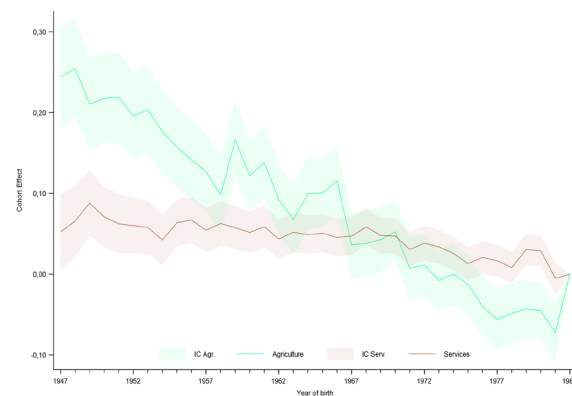
Level of Education

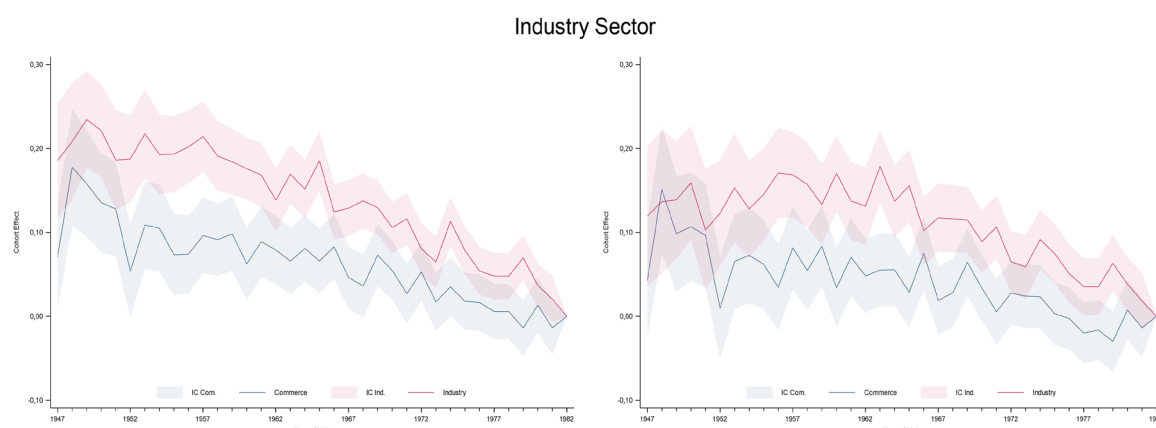


Employment Sector



Industry Sector





Note: Lines represent estimated cohort effects by category, with shaded areas indicating 95 % confidence intervals. The reference cohort is 1992 for gender and area, and 1982 for employment sector, education level, and economic activity.

Source: ENEMDU, 2007-2022

Elaborated by the authors

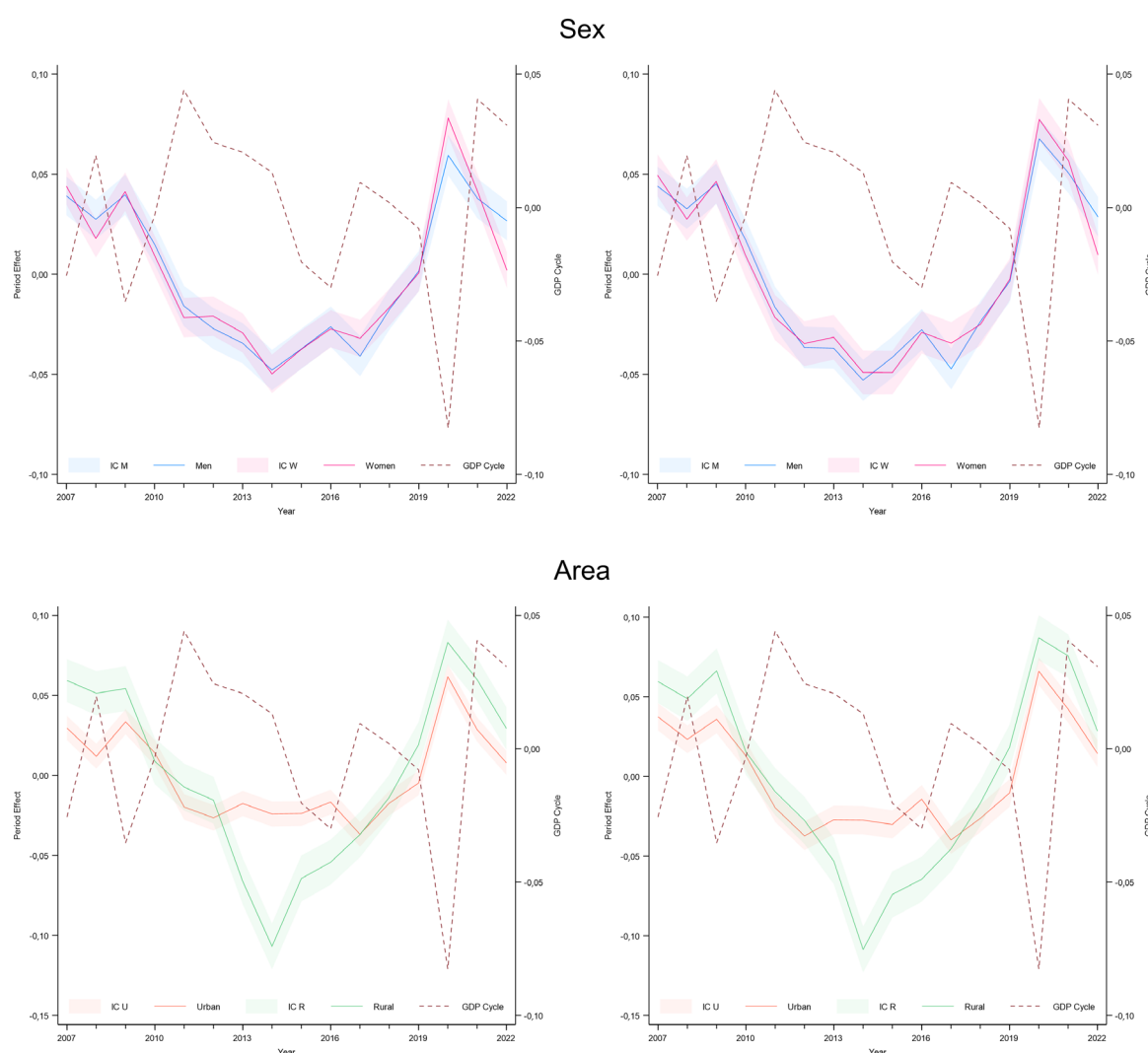
4.3.3. Decomposition of the Period Effect on the In-Work Poverty Rate, by Various Categories

Figure 9 shows the effects of the economic cycle on the in-work poverty rate (IWPR) across different categories, revealing a countercyclical pattern. In the first panel, it is observed that during periods of economic expansion, in-work poverty decreases for both men and women, with women being more affected during recessions. This is due to gender roles that make them more vulnerable to job loss—a phenomenon that was exacerbated during the COVID-19 pandemic, when female employment was 1,8 times more vulnerable than male employment (OIT, 2022). The second panel shows that the IWPR is more sensitive in rural areas than in urban ones, reaching its highest point in 2020 due to the impact of the pandemic. The third panel shows that the IWPR also follows a countercyclical pattern by education level, being lowest among workers with higher education. The fourth panel indicates that both formal and informal employment follow a countercyclical pattern, but the informal sector is more severely affected—especially during the 2020 crisis, when the rapid loss of jobs and income led to a sharp increase in in-work poverty. It is estimated that 35 million workers in Latin America lost their jobs (Beccaria et al., 2022). Finally, the fifth panel confirms that the IWPR across all economic sectors exhibits a countercyclical trend, with significant increases during economic recessions.

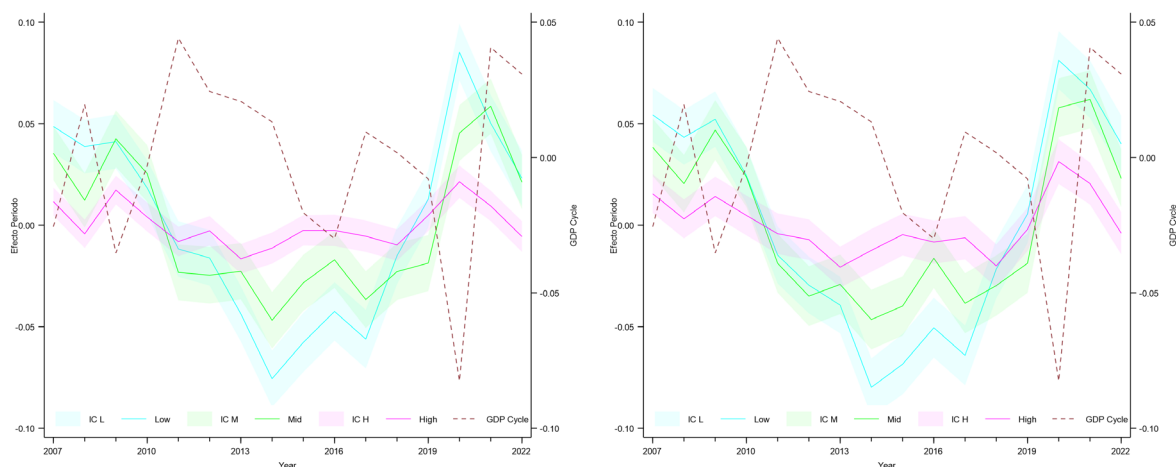
Overall, the results show that the in-work poverty rate (IWPR) follows a countercyclical pattern—declining during periods of economic expansion

and increasing during times of crisis—reflecting a pro-poor trend, as it disproportionately affects the most vulnerable groups during recessions. These findings underscore the need for public policies aimed at protecting vulnerable populations—such as women, rural workers, informal workers, individuals with low levels of education, and those employed in the agricultural sector—particularly during economic downturns, in order to improve the working conditions and wages of the working poor.

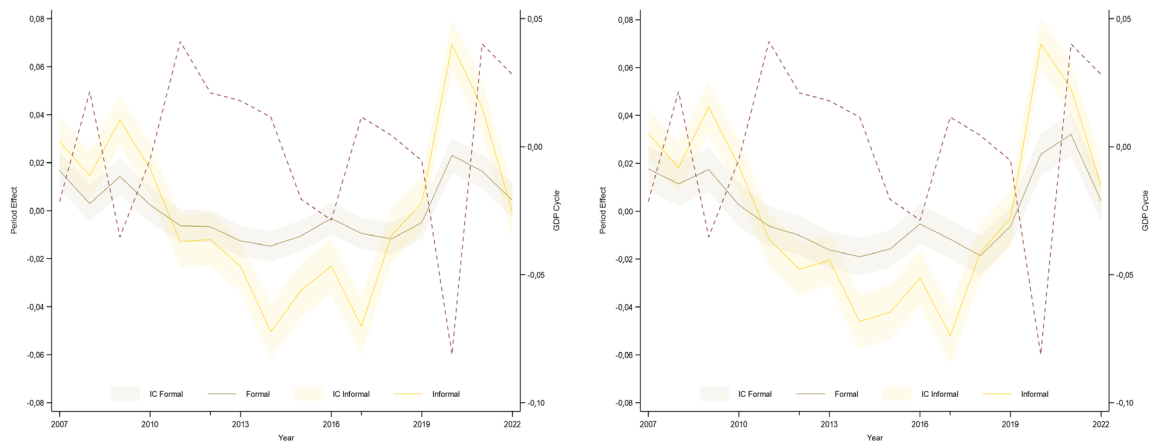
Figure 9. Decomposition of the Period Effect on the In-Work Poverty Rate, by Category. In-Work Poverty—All Income Sources (Left Panel) and In-Work Poverty—Labor Income Only (Right Panel)



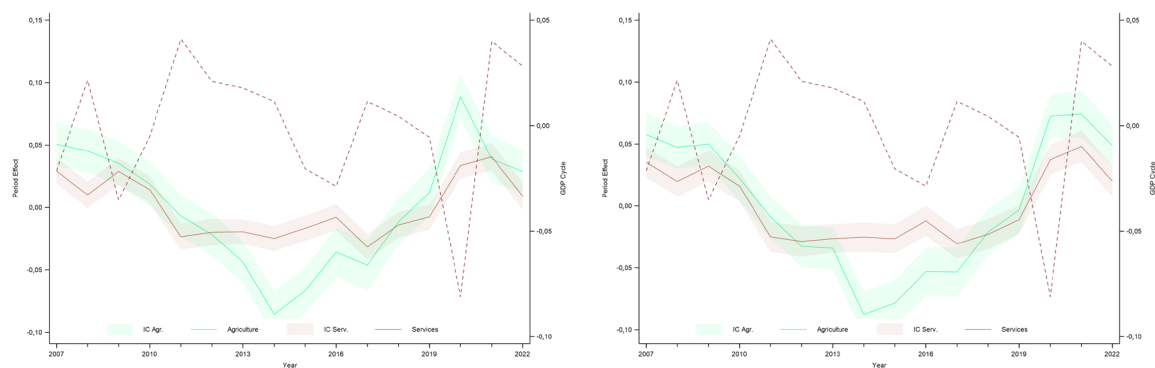
Level Education

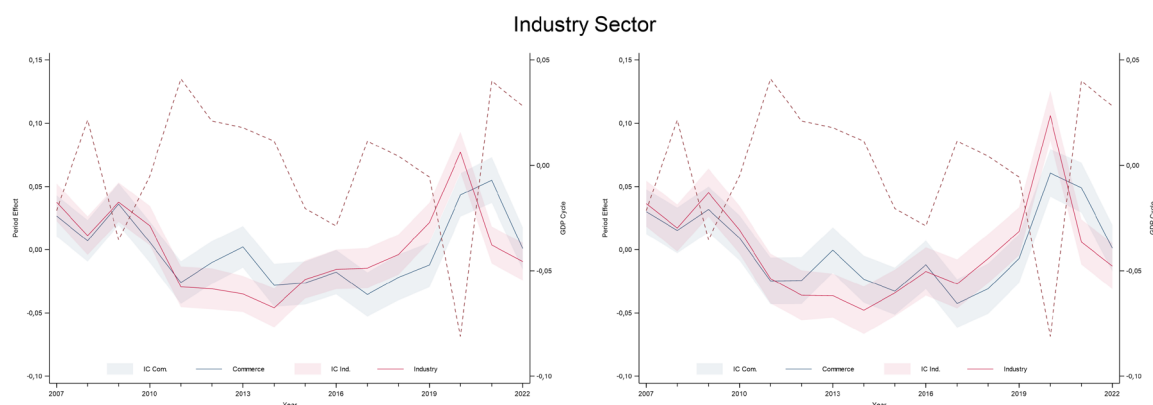


Employment Sector



Industry Sector





Note: Lines represent estimated period effects by category, with shaded areas indicating 95 % confidence intervals. Coefficients for 2007 and 2008 were obtained under the constraint that period effects sum to zero (as per Equation 2). The dashed line represents the cyclical component of real GDP, estimated using the Hodrick-Prescott filter and displayed on the secondary axis.

Source: ENEMDU, 2007-2022

Elaborated by the authors

4.4. Additional Socioeconomic Determinants of In-Work Poverty

The findings reveal variations in the in-work poverty rate across the life cycle, economic cycle, and generations. Using Equation 1, the analysis also examines key determinants of in-work poverty, including individual attributes (gender, residence, education, marital status), labor market conditions (employment type, sector, firm size, minimum wage), and household characteristics (dependency and employment ratios).

In theory, minimum wage increases can raise the earnings of low-wage workers, particularly those at the bottom of the income distribution, but they may also cause unintended effects such as job losses or shifts to informal employment. Evidence from developing countries reflects this duality. For instance, Wong (2019) finds that Ecuador's 2012 sectoral minimum wage hike significantly increased low-income workers' wages while reducing the earnings of high-wage workers. These dynamics highlight the need to consider the relative value of the minimum wage when analyzing labor poverty. Since the minimum wage is nationally set but varies in its local impact, Lee's (1999) approach is followed to construct a provincial-level measure of its relative bindingness:

$$\log(\text{MW}_{p,t}) = \log(\text{MW}_t) - \log(w_{p,t}^{50}) \quad (4)$$

Where $\text{MW}_{p,t}$ denotes the nationally mandated minimum wage and $w_{p,t}^{50}$ represents the median wage in province p at time t . This measure captures

how binding the national minimum wage is in each province, allowing the analysis to account for regional heterogeneity in its effects on labor poverty.

It is important to note that these models are purely illustrative and do not allow for the identification of causal relationships due to potential endogeneity². For instance, there may be reverse causality between informal employment and in-work poverty, as well as omitted regional shocks or unobserved local labor market conditions. Future research could address these limitations by implementing instrumental variable (IV) approaches or including regional and policy controls to improve the robustness and interpretability of the determinants. The estimation results are interpreted below.

² The APC model with a pseudo-panel showed no issues of heteroskedasticity or autocorrelation (Breusch-Pagan and Wooldridge tests), and fixed and random effects yielded similar results (Hausman test). Additionally, there was no unexplained cohort-level variability (Breusch-Pagan test for random effects).

Table 4. Estimates of the In-Work Poverty Rate with Additional Socioeconomic Determinants

Variable	In-Work Poverty—All Income Sources (IWPT)				In-Work Poverty—Labor Income Only (IWPWT)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age effect	25,34	8,244	5,603	2,514	28,98	7,936	4,800	2,404
Prob > F	0,0000	0	0,0001	0,0000	0,0000	0,0000	0,0000	0,0000
Cohort effect	3,179	2,924	1,972	1,612	9,100	2,757	1,751	1,541
Prob > F	0,0000	0,0000	0,0000	0,0058	0,0000	0,0000	0,00136	0,0000
Period effect	98,60	33,15	3,532	4,173	81,56	32,67	4,125	4,299
Prob > F	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0114
Female		-0,045	-0,000	-0,007		-0,013	-0,025	-0,045
		(0,1123)	(0,1046)	(0,1031)		(0,1035)	(0,0964)	(0,0957)
Rural		0,432***	0,246	0,181		0,149	0,013	-0,017
		(0,1326)	(0,1583)	(0,1562)		(0,1208)	(0,1459)	(0,1451)
Years of Schooling		-0,039***	-0,029***	-0,022***		-0,036***	-0,026***	-0,022***
		(0,0087)	(0,0085)	(0,0082)		(0,0080)	(0,0078)	(0,0076)
Married		-0,064	-0,048	-0,149**		0,131**	0,104*	0,028
		(0,0617)	(0,0612)	(0,0640)		(0,0570)	(0,0565)	(0,0592)
Services			-0,435**	-0,354**			-0,445***	-0,369**
			(0,1780)	(0,1729)			(0,1649)	(0,1617)
Commerce			-0,396**	-0,270			-0,437**	-0,342**
			(0,1892)	(0,1832)			(0,1750)	(0,1712)
Industry			-0,299**	-0,280**			-0,350**	-0,328**
			(0,1487)	(0,1421)			(0,1381)	(0,1330)
Informal			0,204*	0,177			0,305***	0,270***
			(0,1091)	(0,1080)			(0,1005)	(0,1001)

Variable	In-Work Poverty—All Income Sources (IWPT)				In-Work Poverty—Labor Income Only (IWPWT)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Minimum wage			-0,262 (0,1743)	-0,051 (0,1759)			-0,383** (0,1619)	-0,228 (0,1643)
Household dependency ratio				0,058** (0,0286)				0,062** (0,0263)
Household employment ratio				-0,531*** (0,1430)				-0,290** (0,1329)
Constant	0,530*** (0,0213)	0,757*** (0,2611)	0,635** (0,3111)	0,677* (0,4004)	0,476*** (0,0202)	1,358*** (0,2431)	1,030*** (0,2890)	0,870** (0,3720)
Observations	595.924	593.664	435.107	435.107	595.924	593.664	435.107	435.107
Number of groups	681	681	681	681	681	681	681	681
R-squared	0,800	0,570	0,496	0,477	0,801	0,641	0,611	0,598

Note: Standard errors in parentheses *** p<0,01, ** p<0,05, * p<0,1. The reference categories are male, urban area, other marital status, Amazon region, agricultural sector, and small enterprise. Additionally, we control for regional location and the size of the firm where the worker is employed.

Source: ENEMDU, 2007–2022

Elaborated by the authors

Table 4 shows that additional socioeconomic factors significantly influence the in-work poverty rate (IWPT and IWPWT). The age, period, and cohort effects remain statistically significant across models, highlighting their central role in shaping IWPR over time, across life stages, and between generations—a result confirmed by joint significance tests.

Regarding socioeconomic variables, worker cohorts in rural areas face a higher likelihood of remaining in in-work poverty compared to their urban counterparts. As Bennett (2017) explains, this disparity stems from the greater employment precariousness in rural areas, where job conditions are more unstable and wages lower than in urban settings with broader opportunities.

Results for education show a negative and statistically significant relationship between the average years of schooling per cohort and the in-work poverty rate. As the average educational level within a cohort increases, in-work poverty tends to decrease—by 2.2 percentage points (column 4 and 8). This finding aligns with the studies of Fredes (2021), Maurizio (2018), and Tejero (2017), which argue that education reduces the likelihood of experiencing in-work poverty, particularly in contexts with high levels of labor informality, such as in Ecuador. From a human capital theory perspective, education enhances workers' skills and productivity, enabling them to access more formal and better-paid employment (Becker, 1964), thereby reducing the risk of in-work poverty.

The negative but statistically insignificant coefficient for married in the IWPT model suggests that, once transfers are included, marriage may reduce in-work poverty—likely via spousal financial support. These findings are consistent with Tejero (2017) who reports no significant difference between married and single individuals, but highlights greater vulnerability among those who are separated, divorced, or widowed. Although our analysis does not explicitly examine these subgroups, the results emphasize the relevance of marital status and family stability in shaping exposure to in-work poverty—particularly in contexts where social safety nets are limited.

The economic sector is a key determinant of in-work poverty, with notable differences across areas of production. Compared to agriculture—the reference category—employment in commerce, industry, and particularly services significantly reduce in-work poverty. These findings suggest that these sectors offer greater protection against in-work poverty, likely due to more stable employment and higher wages. As Rodríguez Cabrero (2010) and Bennett (2017) point out, agriculture is particularly vulnerable due to its seasonal, low-paid, and precarious jobs. While commerce and industry also include heterogeneous job types, they appear to offer better conditions than agriculture, contributing to a lower risk of in-work poverty.

Regarding employment type, this study finds that labor informality has a positive and statistically significant effect on in-work poverty, indicating that informal workers are more likely to experience poverty than those in formal employment. This aligns with findings by Bennett (2017), Rodríguez

Cabrero (2010), and Tejero (2017), who emphasize that informality—marked by unstable jobs, low wages, lack of social benefits, and limited legal protections—intensifies economic vulnerability. In sectors with high turnover and temporary contracts, informality reinforces precarious conditions, contributing to the persistence of in-work poverty over time.

The results show that increases in the relative minimum wage are associated with reductions in labor poverty when poverty is calculated based solely on labor income. This suggests that minimum wage policy can boost earnings and reduce poverty through labor income, highlighting its redistributive potential, as shown by Wong (2019) for Ecuador.

Household characteristics also significantly influence in-work poverty. A higher household dependency ratio is associated with increased labor poverty. Conversely, a higher share of employed household members reduces in-work poverty, reflecting the findings of Filandri and Struffolino (2019), who argue that multi-earner households are less prone to poverty than single-earner ones.

5. CONCLUSIONS AND DISCUSSION

5.1. Empirical findings

This study analyzed life-cycle patterns, generational changes, and economic cycles in Ecuador's in-work poverty rate (IWPR), distinguishing between In-Work Poverty-All Income Sources (IWPT) and In-Work Poverty-Labor Income Only (IWPWT). Both showed similar behavior, although IWPWT consistently registered higher levels. Between 2007 and 2022, both rates declined (IWPT from 30,39 % to 20,68 %; IWPWT from 34 % to 28,19 %). The IWPR generally decreases with age but rises during middle and older ages, indicating greater vulnerability, particularly for women—while men experience a more marked decline, possibly due to their higher presence in stable jobs (Van Winkle & Struffolino, 2018).

The IWPR by employment sector follows an inverted “S” pattern: high poverty in youth and older ages, lower in midlife due to gained experience and job stability. This highlights vulnerabilities in early and late working life stages, consistent with Gammarano (2019) and Maurizio (2021). Education significantly impacts IWPR; low-educated workers face high poverty until about age 40, medium-educated until about 32, while highly educated workers maintain low and stable IWPR, reflecting educational wage gaps (Lustig et al., 2013) and better labor market integration (Tejero, 2017). By sector, IWPR declines in agriculture, commerce, and industry but remains stable in services.

Generationally, more recent cohorts show lower IWPR, reflecting improved labor conditions, with more pronounced reductions among men. Among women, older cohorts show persistent labor poverty rates. Rural areas and

lower-educated workers saw the greatest declines. In formal and informal sectors, poverty declined across cohorts, with a steadier decrease in the informal sector. By economic branch, IWPR decreased in agriculture, commerce, and industry but remained stable in services.

Period effects reveal a countercyclical pattern: IWPR rises in downturns and falls in growth periods, disproportionately affecting rural, informal, less educated, and agricultural workers, highlighting structural labor inequalities. Controlling for additional variables, age, period, and cohort effects remain significant. Poverty is higher in rural areas, informal employment, and households with high dependency ratios, and lower among highly educated workers, commerce, and industry sectors, and households with more employed members. Household structure is also a key determinant of labor poverty across cohorts.

5.2. Policy Implications

Results suggest implementing tailored labor policies by life stage: for youth, promoting training and labor market entry with tax incentives and differentiated minimum wages; for individuals in midlife, addressing job precariousness through wage equity and work-family balance; and for older workers, subsidizing social security contributions to encourage formal sector employment. The progress among younger cohorts is promising but requires policies that consolidate labor improvements, especially in informal sectors and for low-educated workers, by strengthening vocational training aligned with labor demand. Persistent IWPR among medium and highly educated groups calls for better alignment between academic training and market needs to improve employability and reduce professional oversupply. In rural areas, agricultural modernization should be paired with productive diversification and infrastructure development.

To mitigate countercyclical IWPR fluctuations, targeted policies are essential to protect vulnerable groups during downturns. Rural workers need support networks including temporary subsidies, employment programs, and digital platforms connecting rural labor to urban jobs. The informal sector requires formalization incentives, technical assistance, hiring subsidies, and digital and technical skills training. For low-educated workers, expanding access to technical training in high-demand fields is crucial. In agriculture, improving access to productive technologies through training, innovation centers, and financing, alongside public-private partnerships to enhance rural infrastructure and market access, is key to ensuring employment stability and reducing in-work poverty, especially in economic crises.

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APPENDIX

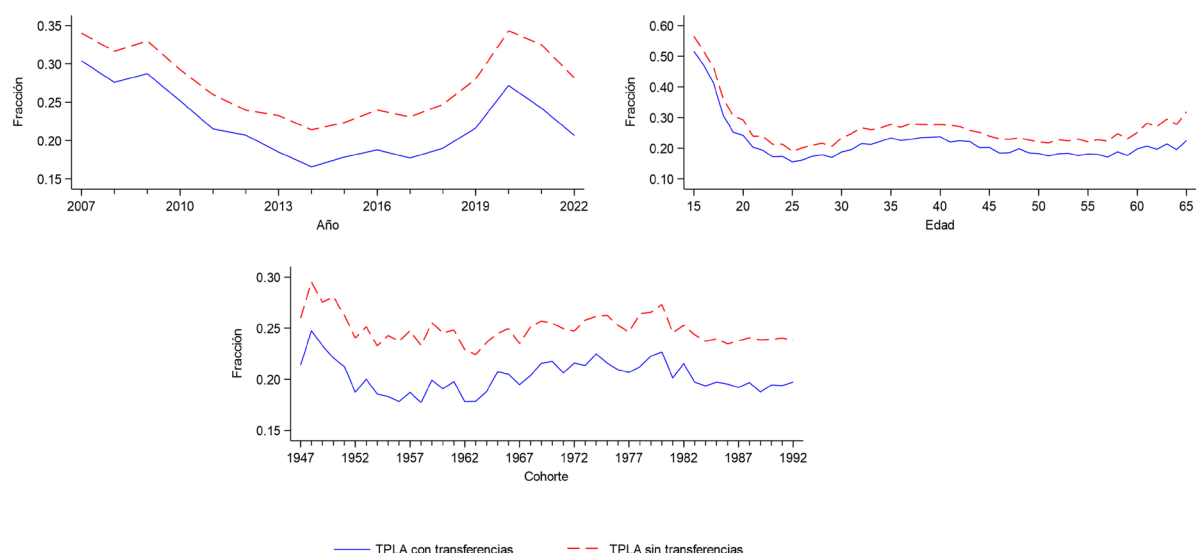
Appendix A. Share of Poor and Non-Poor Employees

Year	With Transfers		Without Transfers	
	Non-Poor Employees	Poor Employees	Non-Poor Employees	Poor Employees
2007	71,57 %	28,43 %	68,31 %	31,69 %
2008	74,05 %	25,95 %	70,39 %	29,61 %
2009	73,12 %	26,88 %	69,41 %	30,59 %
2010	76,65 %	23,35 %	73,12 %	26,88 %
2011	80,34 %	19,66 %	76,69 %	23,31 %
2012	81,50 %	18,50 %	78,64 %	21,36 %
2013	82,56 %	17,44 %	78,62 %	21,38 %
2014	84,58 %	15,42 %	80,50 %	19,50 %
2015	83,87 %	16,13 %	80,02 %	19,98 %
2016	83,16 %	16,84 %	78,49 %	21,51 %
2017	84,52 %	15,48 %	79,91 %	20,09 %
2018	82,74 %	17,26 %	78,06 %	21,94 %
2019	81,29 %	18,71 %	76,08 %	23,92 %
2020	75,04 %	24,96 %	68,71 %	31,29 %
2021	78,14 %	21,86 %	70,57 %	29,43 %
2022	80,84 %	19,16 %	74,02 %	25,98 %
Total	79,78 %	20,22 %	75,25 %	24,75 %

Source: ENEMDU, 2007-2022

Elaborated by the authors

Appendix B. Trends in the In-Work Poverty Rate by Period, Age, and Cohort



Source: ENEMDU, 2007-2022

Elaborated by the authors

Appendix C. Global Significance Test of the APC Model

Variables	Absolute In-Work Poverty Rate with Transfers		Absolute In-Work Poverty Rate without Transfers	
	All Households	Households with a Single Worker	All Households	Households with a Single Worker
Age effect	28,98	26,46	22,34	22,65
Prob > F	(0,0000)	(0,0000)	(0,0000)	(0,0000)
Cohort effect	9,100	9,496	3,179	3,160
Prob > F	(0,0000)	(0,0000)	(0,0000)	(0,0000)
Period effect	81,56	85,48	98,60	101,8
Prob > F	(0,0000)	(0,0000)	(0,0000)	(0,0000)
Constant	0,476*** (0,0202)	0,476*** (0,0214)	0,530*** (0,0213)	0,530*** (0,0226)
Observations	595,924	185,563	595,924	185,563
R-squared	0,801	0,800	0,800	0,800
Number of groups	681	681	681	681

Standard errors in parentheses. *** $p < 0,01$, ** $p < 0,05$, * $p < 0,1$

Source: ENEMDU, 2007-2022

Elaborated by the authors

Appendix D. In-Work Poverty—All Income Sources by Characteristics

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Absolute Working Poverty with Transfers																	
Poor Worker	30,39 %	27,60 %	28,73 %	25,18 %	21,52 %	20,71 %	18,50 %	16,58 %	17,84 %	18,80 %	17,72 %	19,00 %	21,63 %	27,18 %	24,23 %	20,68 %	22,09 %
Area																	
Urban	37,52 %	36,71 %	38,72 %	38,60 %	34,21 %	33,09 %	39,27 %	41,14 %	38,01 %	37,48 %	32,01 %	34,87 %	33,02 %	41,92 %	37,37 %	34,01 %	36,83 %
Rural	62,48 %	63,29 %	61,28 %	61,40 %	65,79 %	66,91 %	60,73 %	58,86 %	61,99 %	62,52 %	67,99 %	65,13 %	66,98 %	58,08 %	62,63 %	65,99 %	63,17 %
Sex																	
Male	62,40 %	63,18 %	61,47 %	63,36 %	63,37 %	60,86 %	62,13 %	61,61 %	60,60 %	58,57 %	57,08 %	58,18 %	58,16 %	57,86 %	57,00 %	57,37 %	60,06 %
Femal	37,60 %	36,82 %	38,53 %	36,64 %	36,63 %	39,14 %	37,87 %	38,36 %	39,40 %	41,43 %	42,92 %	41,82 %	41,84 %	42,14 %	43,00 %	42,63 %	39,94 %
Education Level (Old System)																	
No education	10,65 %	11,42 %	10,48 %	11,06 %	12,56 %	12,28 %	9,26 %	8,20 %	7,71 %	7,64 %	8,71 %	8,33 %	6,90 %	5,40 %	3,68 %	6,09 %	8,58 %
Primary	60,61 %	59,89 %	57,45 %	57,04 %	56,48 %	55,70 %	57,84 %	56,88 %	54,06 %	52,83 %	51,72 %	53,17 %	53,89 %	46,31 %	48,38 %	42,74 %	53,75 %
Secondary	25,40 %	25,78 %	27,70 %	27,93 %	27,12 %	27,78 %	30,25 %	31,46 %	34,51 %	35,95 %	36,17 %	35,75 %	36,16 %	43,92 %	44,40 %	49,15 %	32,21 %
Higher Education	3,34 %	2,90 %	4,36 %	3,97 %	3,84 %	4,24 %	2,65 %	3,46 %	3,72 %	3,58 %	3,41 %	2,75 %	3,05 %	4,37 %	3,53 %	2,02 %	3,46 %
Employee Sectors																	
Formal salaried	3,70 %	3,48 %	4,29 %	4,68 %	4,93 %	4,46 %	4,49 %	4,58 %	4,43 %	3,76 %	2,89 %	1,80 %	2,03 %	2,56 %	2,30 %	1,86 %	3,43 %
Informal salafied	55,86 %	57,48 %	53,48 %	51,37 %	47,66 %	47,22 %	48,53 %	47,28 %	48,86 %	47,69 %	50,82 %	52,74 %	52,89 %	50,54 %	53,69 %	57,87 %	51,85 %
Industry sector																	
Agriculture and Mining	56,03 %	56,73 %	55,09 %	55,93 %	60,61 %	60,20 %	55,10 %	54,07 %	55,07 %	56,24 %	59,55 %	60,83 %	61,16 %	58,25 %	60,42 %	64,59 %	58,19 %
Services	15,68 %	15,41 %	16,42 %	16,21 %	13,10 %	13,97 %	16,88 %	17,72 %	18,06 %	17,15 %	14,96 %	14,99 %	15,61 %	15,95 %	16,22 %	15,24 %	15,82 %
Commerce	14,23 %	13,76 %	14,79 %	14,44 %	14,01 %	14,36 %	14,59 %	14,87 %	13,84 %	13,11 %	12,20 %	11,41 %	11,21 %	14,75 %	14,75 %	10,37 %	13,58 %
Manufacturing	8,58 %	8,26 %	8,41 %	8,36 %	7,19 %	6,91 %	7,87 %	8,16 %	7,08 %	7,63 %	8,42 %	6,68 %	7,22 %	7,14 %	4,71 %	3,88 %	7,25 %
Construction	5,48 %	5,84 %	5,29 %	5,06 %	5,09 %	4,56 %	5,57 %	5,18 %	5,95 %	5,87 %	4,86 %	6,09 %	4,80 %	3,91 %	3,90 %	5,92 %	5,17 %
Age group																	
<15	8,03 %	5,77 %	5,67 %	4,22 %	3,10 %	4,01 %	4,03 %	4,34 %	5,13 %	6,74 %	7,71 %	7,22 %	12,35 %	6,88 %	12,49 %	8,52 %	6,95 %
15-24	19,59 %	19,81 %	20,09 %	18,09 %	15,72 %	16,53 %	14,84 %	16,81 %	17,26 %	16,97 %	19,08 %	17,88 %	18,26 %	20,43 %	19,82 %	19,58 %	18,43 %
25-34	20,02 %	19,72 %	17,88 %	17,80 %	18,53 %	16,33 %	21,45 %	21,69 %	22,39 %	21,39 %	20,66 %	18,29 %	17,56 %	18,97 %	15,72 %	17,04 %	18,90 %
35-44	20,86 %	21,61 %	21,82 %	22,80 %	22,26 %	21,83 %	26,34 %	26,01 %	23,74 %	22,64 %	22,32 %	24,43 %	20,82 %	22,61 %	23,53 %	22,03 %	22,71 %
45-54	14,32 %	15,02 %	15,51 %	16,63 %	16,98 %	17,28 %	15,72 %	14,68 %	15,08 %	15,51 %	14,68 %	15,34 %	15,83 %	15,06 %	12,78 %	14,14 %	15,23 %
55-64	8,86 %	9,48 %	10,16 %	10,93 %	11,35 %	11,64 %	10,00 %	8,72 %	8,91 %	8,79 %	8,72 %	9,69 %	9,32 %	10,44 %	11,29 %	13,40 %	10,19 %
>65	8,32 %	8,59 %	8,88 %	9,52 %	12,06 %	12,37 %	7,63 %	6,83 %	7,48 %	7,96 %	6,83 %	7,15 %	5,76 %	5,60 %	4,37 %	5,29 %	7,59 %

Source: ENEMDU, 2007-2022

Elaborated by the authors

Appendix E. In-Work Poverty Rate In-Work Poverty—Labor Income Only (IWPWT) by Characteristics.

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Absolute Working Poverty without Transfers																	
Poor Worker	34,00 %	31,64 %	33,01 %	29,24 %	25,99 %	23,96 %	23,37 %	21,41 %	22,35 %	23,98 %	23,08 %	24,71 %	28,03 %	34,31 %	32,51 %	28,19 %	27,44 %
Area																	
Urban	41,30 %	41,45 %	41,05 %	41,53 %	38,73 %	37,42 %	40,96 %	44,87 %	42,51 %	43,68 %	38,71 %	38,90 %	36,78 %	44,25 %	42,08 %	40,49 %	40,97 %
Rural	58,70 %	58,55 %	58,95 %	58,47 %	61,27 %	62,58 %	59,04 %	55,13 %	57,49 %	56,32 %	61,29 %	61,10 %	63,22 %	55,75 %	57,92 %	59,51 %	59,03 %
Sex																	
Male	61,42 %	61,97 %	60,46 %	62,16 %	61,50 %	59,93 %	60,21 %	59,20 %	59,10 %	57,06 %	55,32 %	56,89 %	56,20 %	57,05 %	55,01 %	56,59 %	58,52 %
Femal	38,58 %	38,03 %	39,54 %	37,84 %	38,50 %	40,07 %	39,79 %	40,80 %	40,90 %	42,94 %	44,68 %	43,11 %	43,80 %	42,95 %	44,99 %	43,41 %	41,48 %
Education Level (Old System)																	
No education	10,13 %	10,55 %	10,38 %	10,71 %	12,48 %	11,37 %	9,66 %	8,25 %	7,98 %	7,58 %	8,50 %	8,42 %	8,03 %	7,53 %	4,62 %	6,90 %	8,72 %
Primary	59,04 %	58,03 %	56,75 %	56,07 %	54,29 %	54,96 %	56,20 %	54,75 %	52,13 %	50,87 %	49,91 %	52,59 %	51,91 %	43,97 %	47,70 %	43,26 %	52,13 %
Secondary	26,80 %	27,46 %	28,24 %	28,68 %	28,48 %	28,60 %	30,32 %	32,54 %	34,82 %	36,61 %	36,96 %	35,39 %	36,07 %	42,63 %	42,33 %	45,80 %	34,57 %
Higher Education	4,03 %	3,96 %	4,64 %	4,54 %	4,76 %	5,06 %	3,83 %	4,46 %	5,07 %	4,94 %	4,62 %	3,61 %	4,00 %	5,87 %	5,36 %	4,04 %	4,58 %
Employee Sectors																	
Formal salaried	3,84 %	3,95 %	4,35 %	4,99 %	5,33 %	5,11 %	5,23 %	4,81 %	4,89 %	4,47 %	3,51 %	2,36 %	2,44 %	2,37 %	2,58 %	2,12 %	3,73 %
Informal salafied	55,48 %	56,71 %	53,15 %	50,66 %	46,31 %	46,44 %	47,31 %	46,14 %	47,66 %	45,91 %	48,66 %	50,14 %	49,54 %	48,74 %	50,97 %	53,97 %	50,13 %
Industry sector																	
Agriculture and Mining	52,22 %	52,30 %	52,43 %	52,50 %	56,14 %	56,37 %	52,46 %	50,13 %	51,20 %	50,44 %	53,46 %	56,49 %	57,47 %	54,97 %	56,71 %	59,56 %	54,27 %
Services	17,44 %	17,41 %	17,71 %	17,84 %	14,86 %	15,81 %	18,34 %	20,04 %	20,15 %	19,80 %	18,84 %	17,16 %	17,50 %	17,65 %	19,06 %	18,05 %	17,96 %
Commerce	15,75 %	15,39 %	15,67 %	15,75 %	15,77 %	15,74 %	15,29 %	15,95 %	15,33 %	15,48 %	13,85 %	13,06 %	12,82 %	16,10 %	14,23 %	11,59 %	14,80 %
Manufacturing	8,88 %	8,91 %	8,59 %	8,73 %	7,75 %	7,25 %	8,28 %	8,44 %	7,49 %	8,12 %	8,77 %	6,98 %	7,71 %	7,30 %	5,95 %	5,15 %	7,69 %
Construction	5,72 %	5,98 %	5,59 %	5,18 %	5,49 %	4,83 %	5,64 %	5,44 %	5,82 %	6,16 %	5,08 %	6,31 %	4,50 %	3,98 %	4,05 %	5,65 %	5,28 %
Age group																	
<15	7,59 %	5,43 %	5,36 %	3,80 %	2,96 %	3,55 %	3,67 %	3,84 %	4,44 %	5,58 %	6,18 %	6,29 %	10,23 %	5,55 %	9,99 %	5,92 %	5,94 %
15-24	19,83 %	19,80 %	19,89 %	17,67 %	15,12 %	16,11 %	14,38 %	15,97 %	16,64 %	16,09 %	18,36 %	16,61 %	16,90 %	18,34 %	17,95 %	17,57 %	17,49 %
25-34	19,76 %	19,25 %	17,59 %	17,54 %	18,32 %	16,03 %	20,32 %	20,85 %	21,90 %	22,04 %	20,09 %	17,58 %	16,73 %	18,82 %	16,23 %	18,04 %	18,67 %
35-44	20,41 %	21,38 %	21,38 %	22,08 %	21,53 %	21,34 %	24,85 %	24,72 %	22,57 %	21,91 %	21,62 %	22,98 %	20,54 %	20,67 %	22,56 %	21,13 %	21,86 %
45-54	14,46 %	15,12 %	15,41 %	16,84 %	16,36 %	17,73 %	15,92 %	15,40 %	15,01 %	15,12 %	14,59 %	14,95 %	14,91 %	14,94 %	12,66 %	13,58 %	15,03 %
55-64	8,99 %	9,63 %	10,32 %	11,22 %	11,81 %	11,94 %	10,40 %	9,84 %	9,49 %	9,34 %	9,59 %	10,49 %	10,06 %	11,70 %	11,96 %	13,97 %	10,76 %
>65	8,96 %	9,39 %	10,05 %	10,85 %	14,00 %	13,30 %	10,47 %	9,37	9,94 %	9,91 %	9,56 %	11,10 %	10,61 %	9,97 %	8,64 %	9,81 %	10,25 %

Source: ENEMDU, 2007-2022

Elaborated by the authors

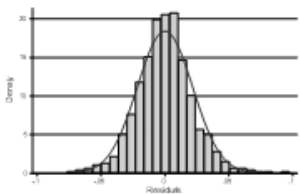
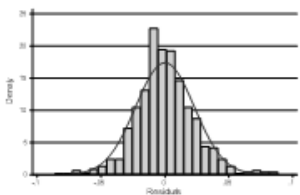
Appendix F. APC Model Tests of the In-Work Poverty Rate—All Income Sources (IWPT) and Labor Income Only (IWPWT) Including Covariates.

Variable	Model	Test	p-value	Criterion $\alpha = 0,05$
In-Work Poverty - All Income Sources (IWPT)	Pooled	BP for heteroskedasticity	0,143	Do not reject H0: Constant variance
		Wooldridge test for autocorrelation	0,739	Do not reject H0: No first-order autocorrelation
	RE	Hausman	1,000	Do not reject H0: No systematic differences between RE and FE estimators
		Breusch and Pagan for random effects	1,000	Do not reject H0: No random effects, $\text{Var}(u) = 0$
In-Work Poverty - Labor or Income Only (IWPWT)	Pooled	BP for heteroskedasticity	0,000	Reject H0: Non-constant variance
		Wooldridge test for autocorrelation	0,587	Do not reject H0: No first-order autocorrelation
	RE	Hausman	1,000	Do not reject H0: No systematic differences between RE and FE estimators
		Breusch and Pagan for random effects	1,000	Do not reject H0: No random effects, $\text{Var}(u) = 0$

Source: ENEMDU, 2007-2022

Elaborated by the authors

Appendix J. Normality Test of the Errors.

Variable	Test	p-value	Criterion $\alpha = 0,05$	Histogram
In-Work Poverty — All Income Sources (IWPT)	Shapiro-Wilk	0,00001	H0 rejected: Error Normality	
In-Work Poverty — Labor Income Only (IWPWT)	Shapiro-Wilk	0,00000	H0 rejected: Error Normality	

Source: ENEMDU, 2007-2022
Elaborated by the authors