LIS
Working Paper Series

No. 828

Age-Income Gaps

Gabriele Guaitoli, Roberto Pancrazi

March 2022

revised in November 2024

Luxembourg Income Study (LIS), asbl

Age-Income Gaps

Gabriele Guaitoli[*] Roberto Pancrazi[†]

INSEAD University of Warwick

November 18, 2024

Abstract

This paper examines the growing income disparities between older and younger individuals. Using harmonized data from 32 countries with varying levels of economic development for the period 2004–2018, we introduce the Age Group Income Ratio (*AGIR*) to measure the relative disposable income of older individuals (aged 50–64) compared to younger individuals (aged 25–34). We establish three stylized facts. First, the age-income gap in favor of older individuals has significantly increased in richer countries and decreased in lower-income countries. Second, these opposing trends have different causes. In richer countries, the increase in the age-income gap is driven by a greater rise in the employment rate of older individuals relative to younger ones. In poorer countries, the decline is due to the wages of younger individuals in employment growing faster than those of older individuals. For this reason, measures of age-income gaps based solely on labor earnings fail to capture the crucial role of employment, underestimating these recent trends. Third, the converge in education rates between young and old, in favor of the latter, explains 30% of the *AGIR* increase in richer countries. The increase in female labor force participation only had a minor role. Importantly, we show that the growth of the age-income gap in richer countries is unlikely to revert, as education and employment rates across age groups continue to converge.

Keywords: Age group income, growth decomposition, income distribution, cross-country comparison.

JEL Classification: E24, J31, O57

[*]E-mail: gabriele.guaitoli@insead.edu

[†]Corresponding author: Roberto Pancrazi, Department of Economics, University of Warwick, United Kingdom; E-mail address: R.Pancrazi@warwick.ac.uk. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. Declarations of interest: none.

1 Introduction

The growing income divergence between older and younger individuals, favoring the former, has become a prominent topic in many industrialized countries' political and media discourse. For instance, the House of Lords in the UK and the European Commission in the EU have published comprehensive reports on this issue, highlighting that "the young are facing a future of low pay, high rent, and few incentives" and are "struggling to find secure, well-paid jobs" (House of Lords, 2019; Raitano et al., 2021). Additionally, other institutions have conducted studies on this topic focusing on specific countries such as France (Masson, 2021), Ireland (Barra et al., 2021), Australia (Berry and Sinclair, 2010; Miller et al., 2020), and the UK (Henehan et al., 2021).

This phenomenon has also gathered attention in the academic literature, particularly in analyzing the extent and sources of the (labor) earnings gap between older and younger workers. Examples include Bianchi and Paradisi (2024), which examines the relative wage levels of young and older workers in Italy, and Freedman (2024), which studies the labor earnings of different age groups in eight rich countries. However, these works solely focus on individuals in employment and overlook other sources of income. While this approach is suitable for studying wage dynamics, it may have limitations when it aims to analyze the overall evolution of age-income inequalities. Firstly, it is unclear whether wages are the main factor contributing to the increase in age-income disparities among different age groups. Secondly, other income margins, such as employment rates and public transfers, may have evolved differently than wages over time and across countries, thus making the age-earnings gap an inadequate proxy for comparing the global evolution of age-income disparities.

This paper addresses these shortcomings by analyzing the evolution of the disposable income - and its components - of older and younger individuals across 32 countries at different ends of the economic development spectrum. We leverage income microdata harmonized in the Luxembourg Income Study Database (LIS) to create a dataset covering the period 2004-2018. For this purpose, we define and analyze the *Age Group Income Ratio*, (henceforth, *AGIR*), which captures with a simple metric the relative average disposable income of the old and young in any given period. While the absence of a panel dimension in the income surveys within the LIS and the relatively short duration of the available sample prevents a full cohort analysis, our measure still provides valuable insights into income dynamics across cohorts. Specifically, the *AGIR* captures the relative distance between the final income of one cohort and the initial income of a new cohort that starts in the same period. Understanding this distance is crucial for analyzing the distribution of economic resources and living standards across age groups at a given point in time, a concept linked to generational conflicts over policy (vonWeizsacker, 1996) and social segregation (Sabater and Finney, 2023). Our comprehensive dataset enables us to uncover regularities in the international evolution of the age-income gap and to highlight how it differs from the more frequently studied age-earnings gap.

Our study presents three primary findings that establish three new stylized facts. First, the age-income gap has followed different trends across countries: it has grown in favour of the old in richer countries (Western Europe, North America), but it has fallen in poorer ones (Eastern Europe, South America). In fact, the *AGIR*, i.e., the ratio between the average income of 50-64 years old individuals (henceforth, the "old") and 25-34 years old ones (henceforth, the"young"), has increased by 18 percentage points (pp), from 1.13 to 1.31, in richer countries. In contrast, it has fallen by 8 pp in poorer countries, from 1.14 to 1.06.

Second, the evolution of the conventionally studied age-earnings gap is not the main driver of the growth in age-income gaps in richer countries. By decomposing income growth into its components (labor earnings, employment, and size of transfers and the share of individuals receiving them), we find that the faster increase in the employment rate of the old relative to the young explains alone two third of the increased *AGIR* in rich countries. We label this channel as the *employment margin*. In contrast, most of the reduction in income inequalities in poorer countries has been driven by the stronger wage growth of young workers (*earnings margin*). As a result, we provide evidence that estimates of age inequalities that focus on labor income (such as the "age-earnings gap") severely underestimate the increase of age-income gaps in rich countries and their reduction in poorer countries. In one-third of the countries in our sample, the ratio of employees' labour earnings has evolved in the opposite direction of the overall population's *AGIR* between 2004 and 2018. These patterns suggest that the causes of the rise in *AGIR* in richer economies should be explored by looking at phenomena connected to the long-run trends that might have affected labor force participation at the later stage of the working career.

Accordingly, as a third contribution of our paper, we investigate whether long-term demographic trends can account for the significant increase in the *AGIR* and the substantial *employment margin* observed in richer countries. To begin, we provide evidence that three well-known key trends in these economies have had uneven impacts across age groups: (1) increased education levels, by which older cohorts became progressively more educated, see (Goldin and Katz, 2007, 2018a); (2) increased late-career female labor market participation (Costa, 2000; Olivetti and Petrongolo, 2016; Goldin and Katz, 2018b); and (3) increase in the minimum pension age (Pilipiec et al., 2021; Staubli and Zweimüller, 2013). To isolate the effects of these trends, we conduct counterfactual analyses. First, we examine the scenario where education convergence is halted by assuming that the education rates in 2018 are the same as those in 2004 for all combinations of males, females, young, and older workers. This analysis implies a 30% reduction in the average *GRD* in richer countries, primarily due to a smaller increase in employment rates among older workers. This finding suggests that the education convergence of older workers significantly contributes to the rise in *AGIR*. Next, to assess the impact of increased female labor force participation among older individuals, we recompute the *GRD* for each country, assuming that the employment gap between older and younger females follows the same trend as that of males. This channel appears to have a smaller impact on the *GRD*, accounting for approximately 4% of the increase in *AGIR*. Finally, we investigate the role of recent policies that have changed the minimum retirement age. We construct an alternative *AGIR* measure by redefining "old" as individuals younger than the lower minimum pension age observed from 2004 to 2018. This adjustment provides an alternative definition for the older age group that aims to insulate our statistics from changes in the minimum age threshold for retirement and demographic ageing. With this new definition, the growth of $AGIR$ is even higher than our baseline estimate (1.21 compared to 1.18), indicating that changes in retirement age policies are not the primary driver of the observed increase in $AGIR$ in wealthy countries. Nevertheless, for this alternative definition of the old the role of education convergence and female labor participation is even higher (respectively 33% and 12% of the observed GRD).

Our findings carry significant implications for the ongoing debate on intergenerational fairness, as they reveal that the income gap between older and younger workers could continue to widen if current demographic and economic trends persist. Specifically, the continued convergence of education of older workers towards those of younger workers may exacerbate age-based income inequality, intensifying disparities in disposable income across generations. This is particularly concerning in wealthy countries, where older workers are increasingly likely to remain in the workforce longer and at higher income levels, while younger workers face stiffer competition and often fewer economic advantages. Using back-of-the-envelope calculations, we project that under full convergence of education rates between young and old workers and of emplyoment rates between male and female for each age group—assuming all other factors remain equal—the average $AGIR$ in rich countries could increase significantly from its current level of 1.31 to 1.43. This effect is even more pronounced in certain countries, with estimated peaks reaching 1.98 in Spain and 2.07 in Italy. These projections underscore the urgency for academics and policymakers to further investigate the long-term effects of these trends on generational equity. Without intervention, the growing income divide may strain intergenerational solidarity and could lead to a scenario where younger generations face systematically reduced economic opportunities compared to their older counterparts.

Related Literature Age group wage dynamics have been discussed for decades. During the 1970s and 1980s, economists focused on the "baby-boom" generation's ingress in the labor market, which increased the relative supply of young, inexperienced labor (Welch, 1979; Levine and Mitchell, 1988). Since economists tried to explain the consequent wage trends with the imperfect substitutability of labor inputs with different tenure/experience, many concluded that the wages of the successive, smaller cohorts were set to grow faster once the aging baby boomers created an excess supply of "experienced" labor (Jeong et al., 2015). We document that this is not the case in most advanced economies. Similar trends have been shown for individual countries by Rosolia and Torrini (2007) and Naticchioni et al. (2016) for Italy, Guvenen et al. (2022) for the US, and Cribb (2019) for Britain. Bianchi and Paradisi (2024) reach similar conclusions when studying age-wage inequalities in a set of high-income countries (with administrative data for Italy and Germany). Also, Freedman (2024) uses a similar set of countries to study cohort trends in earnings. We contribute by providing further international evidence, with a more comprehensive income definition.

Our analysis focuses on disposable income gaps and their components. Since our data covers advanced economies, Eastern Europe and South America, we are the first to document that age-income inequalities have been diverging between high- and low-income countries, with the two groups following opposite trends. The majority of papers have focused on the relative earnings or wages of employed individuals (Bianchi et al., 2022; Bianchi and Paradisi, 2024; Bennett and Levinthal, 2017; Beaudry et al., 2014; OECD, 2024). However, we show that the biggest contribution to the increase in age inequalities in rich countries came from the faster rise in *employment* among older individuals and not from the faster wage growth of older employees. Guvenen et al. (2022) considers *lifetime* labor earnings of US workers, implicitly accounting for the employment margin of cohorts but without disentangling this margin explicitly. Researchers should be careful when drawing generalized conclusions from the dynamics of the age-*wage* gap, as it may not reflect the dynamics of the overall age-*income* gap. The growth of the age-earnings gap systematically underestimates the change of $AGIR$, whether positive (in richer countries) or negative (in poorer countries).

Finally, we show that these concerns are valid also when looking at sub-populations that may have experienced different labor market dynamics. Therefore, our paper connects to the literature that analyzes the consequences of the long-run increases in female participation (Maxwell, 1990; Costa, 2000; Acemoglu et al., 2004; Goldin, 2006; Olivetti and Petrongolo, 2016; Goldin and Katz, 2018b), education achievement (Goldin and Katz, 2007, 2018a) and retirement age (Pilipiec et al., 2021; Staubli and Zweimüller, 2013). In particular, we focus on the asymmetric effects for old and young workers related to the work of Adão et al. (2024) and Lagakos et al. (2018), among others.

Paper organization. The rest of the paper is organized as follows. In Section 2, we present the data and define the underlying economic variable of interest. In Section 3, we derive two novel stylized facts about how disposable income is distributed across age groups across countries and how that distribution has evolved in the last 25 years. Section 4 shows how long-term demographic trends can explain up a large portion of the increase in $AGIR$ in rich countries. Section 5 sums up our results and discusses future avenues of research.

2 Data, income, and its subcomponents

In this section, we first describe the data and then carefully define the economic variables of interest, i.e., disposable income and its subcomponents.

2.1 Data

We use harmonized microdata provided by the Luxembourg Income Study (LIS), a data archive and research center that collects, harmonizes and distributes microdata to *"enable, facilitate, promote, and conduct cross-national comparative research"* (Luxembourg Income Study (LIS) Database, 2024). The data is derived from surveys or administrative datasets. Each dataset is then harmonized to create variables representing the same income and categorical concepts and to remove errors and inconsistencies.

From the LIS database, we select all countries that satisfy four availability and consistency criteria.

1. **Individual-level data**. We keep only country-year data points with individual-level income data. Household-level income data are unsuitable for comparing the income of young and old individuals for two reasons. First, it is unclear how to attribute incomes

within multi-generational households. Second, there is selection in household formation choices, and its effects can be time-varying.[1]

2. **Long time series**. To coherently analyze the medium-term trends in age inequalities, we need a long enough time series (for each country) located within the same time frame (across countries). Thus, we discard all countries not surveyed at least once between 2004 and 2006 and once between 2015 and 2018.

3. **Consistent income definition**. When a country changes its income reporting approach (gross, net, or mixed) across surveys, we only keep the surveys whose reporting approach has the largest number of observations between 2004 and 2018. We drop all data points with a "mixed" reporting approach.

4. **Further cleaning**. After step (3), we discard all countries with insufficient surveys to satisfy criterion (2). Finally, we drop Luxembourg, where almost 50 percent of workers do not reside in the country, making it unsuitable for our analysis.

This procedure yields a sample of 32 countries and 357 country-year surveys collected between 2004 and 2018. We transform all income variables into real terms and PPP, allowing cross-country and cross-period comparisons.

Waves. Since not all countries are surveyed in the same year, the set of country-year observations is unbalanced. To overcome possible related issues, we group yearly surveys into five *waves*, each of three years, starting from 2004. Hence, the waves are 2004-2006, 2007-2009, 2010-2012, 2013-2015, 2016-2018. We create country-wave data by merging all yearly surveys within a wave, giving equal weight to each yearly survey. This procedure yields 158 country-wave data points and composes an almost perfectly balanced dataset.[2] Table IV in Appendix A reports the data availability.

[1] For example, consider how young individuals who do not exit their parents' household may do so because afford their own accommodation, or expect low returns from moving to better labour markets. If rent growth outpaces the income growth of lower-income individuals, the selection may strengthen, making households with a young household head less representative of the average young person's income.

[2] All our countries have at least one observation per wave, apart from Serbia and Slovenia, which are missing one wave each.

2.2 Income definition and its subcomponents

We now illustrate our variables of interest from the LIS dataset. The observed disposable income of an individual q (in a given year/wave and a given country), denoted y_q, is:

$$y_q = w_q^n + \Theta_q^n \tag{1}$$

where w_q^n denotes net labor income, and Θ_q^n is the net income derived from a subset of transfers, namely pension payments (both public and private), unemployment benefits, scholarships and paid maternity/paternity leave.[3]

While some countries report the income components net of taxes, others report gross income.[4] In such a case, we construct net income as the difference between gross income and income taxes τ_q, i.e. $y_q = w_q^g + \Theta_q^g - \tau_q$.[5]

Remark. Notably, capital income is not available at the individual level. The lack of information about this income dimension does not present a critical problem for our analysis for two reasons. First, even omitting this channel, we will show that the data provide important insights into the role of the labor market for the age income distribution. Second, we believe that, if anything, excluding capital income leads to underestimating the stylised facts presented in the next section since, at least in industrialised countries, wealth has become more concentrated towards the older age groups.[6]

[3] In Appendix B.3 we add household-wide benefits, such as child allowance, housing benefits, and general benefits paid to the household as a whole. The results are both quantitatively and qualitatively similar.

[4] See Table IV in Appendix A for the list.

[5] Notice that τ_q, the observed measure of taxes, does not include taxes on capital income.

[6] While statistics about wealth-age distribution are not homogenous across countries, there is evidence that, at least in industrialized countries, wealth has become more concentrated towards the older age groups. In the US, from 2003 to 2018, the age group 55-69 has increased their share of wealth from 36 to 44 percent, while the age group under 40 has decreased from 8.1 to 5.6 percent (source: Distributional financial account data, Board of Governors of the Federal Reserve system. In Italy, from 1991 to 2010, the share of the wealth of households whose heads were in the age group 55-64 increased from 18 to 24 percent, while the ones whose heads were in the age group 35-44 decreased from 19 to 16 percent (source:(Colombo et al., 2014)). In Australia, from 2003, the average wealth of the age group over 65 increased from 26% higher than average to 34%, while the average wealth of the age group under 35 decreased from 64% lower than average to 70% (source: ABS Surveys of Income and Housing). In Canada, in 1999, the total net worth of the age group 55-64 relative to the age group under 35 was 2.7, while the same ratio was 4.4 in 2019 (source: Survey of Financial Security, Statistics Canada). For each of these countries, the share shifts in wealth in favor of the older age group are sensibly larger than the observed share shift in the demographic composition.

3 Age-income gaps in the XXI Century

We use the LIS data presented above to draw a novel picture of how disposable income is distributed across age groups in each country and how that distribution has evolved in the last 20 years. We will derive three novel stylized facts.

3.1 Age Group Income Ratio

As a parsimonious statistic of the income gap between age groups, we consider the ratio of their average disposable income at a given period: we refer to this statistic as the *Age Group Income Ratio* (*AGIR*). For a given country, and ignoring the country index, let us define with $y_{j,t}$ its average disposable income for age group j at time t. Then, we denote the *AGIR* of a country as $R(t)$:

$$R(t) = \frac{y_{\text{old},t}}{y_{\text{young},t}}.$$

With a simple number, this statistic captures the relative income between two age groups in any given period, similar to the "age-earnings gap". Importantly, unlike the age-earnings gap, the average income is calculated across all individuals, employed or not. Hence, this measure provides a broad picture of how *overall* income is distributed between age groups in a given year.

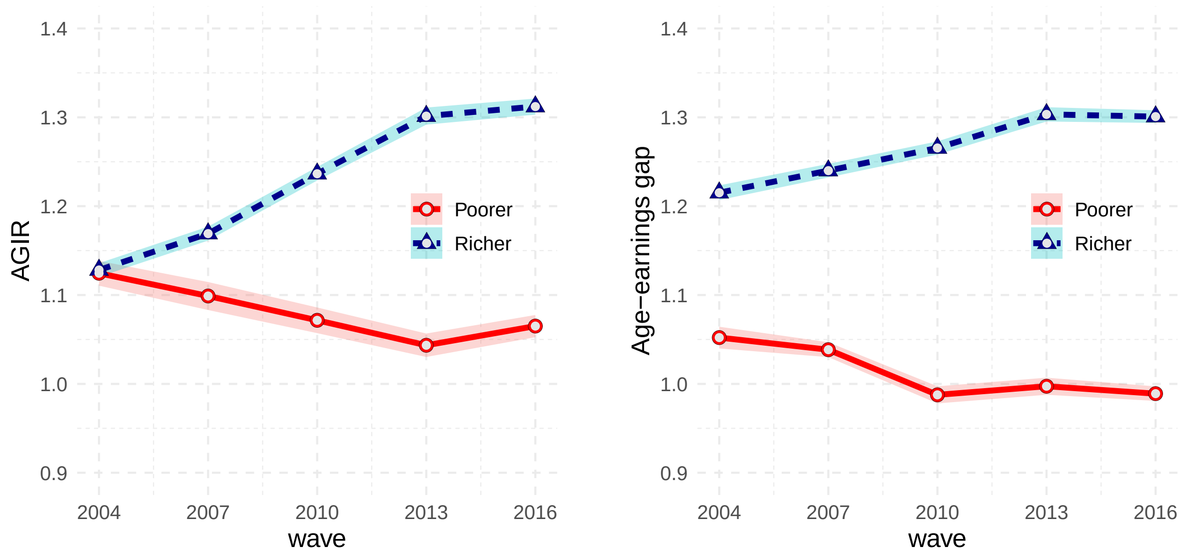
Remark. Notice that the income surveys in the LIS lack a panel dimension and has a relatively short duration of about two decades. Therefore, a full cross-cohort analysis across time is not feasible. Nevertheless, our measure still offers valuable insights into income dynamics across cohorts. Specifically, the *AGIR* captures the relative gap between the ending income of one cohort and the starting income of a new cohort in the same period. Analyzing this difference is essential for understanding how economic resources and living standards are distributed across age groups at a specific point in time, a concept relevant to generational policy conflicts and social segregation (vonWeizsacker, 1996; Sabater and Finney, 2023).

Our analysis focuses on two age groups: individuals aged 50-64 (late-career working-age individuals) and individuals aged 25-34 (early career). We chose these two age groups because they reflect individuals who have already completed their education and are at opposite ends of their work lives. We often refer to these two age groups as the old and the young (workers), respectively.

As an illustrative step, in Figure 1, we plot the evolution of age income and earnings inequalities between old and young. We divide countries into a "richer" or a "poorer" group. The two groups are defined by applying a k-means clustering algorithm, with $k = 2$, on their 2004 GDP (PPP, constant 2017 dollars, per capita) at the beginning of our dataset. The resulting classification matches the 2006 IMF classification (International Monetary Fund, 2006).[7] The left panel displays the simple average of the *AGIR* of all countries comprising the "richer" or "poorer" group for the five waves of surveys starting in 2004. The solid red line reports the average *AGIR* among poorer countries, and the dashed blue line reports the one among richer countries. The right panel displays the average age-earnings gap, defined similarly to our *AGIR* but comparing only employed individuals' net labor income.

Figure 1. *AGIR*, 50-64 vs 25-34 years old

(a) *AGIR* (b) Age-earnings gap



Notes: The figure depicts the Age Group Income Ratio (*AGIR*) of late-career individuals (50-64 years old) and early-career individuals (25-34 years old) in the left panel, and the age-earnings gap, the ratio between the labor earnings of similarly defined categories of employed old and young, in the right panel. The data points represent the simple average across countries of a given group (dashed blue for richer countries, solid red for poorer countries). The shaded area represents the 95 percent confidence interval calculated with the delta method.

[7] The two groups are defined as follows. Richer countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Ireland, Israel, Italy, Netherlands, Norway, Slovenia, Spain, Sweden, Switzerland, United Kingdom, and the United States. Poorer countries: Brazil, Chile, Colombia, Estonia, Mexico, Paraguay, Peru, Poland, Romania, Serbia, Slovakia, and Uruguay.

The figure reveals three facts. First, in the early 2000s, the mean *AGIR* of poorer and richer countries was similar. In poorer countries, the late-career age group's disposable income was, on average, 14 percent higher than the early-career age group's. In richer countries, it was 13 percent higher. Second, and most importantly, the average disposable income of the old relative to the young displays diverging trends for the two groups of countries. In richer countries, the *AGIR* displays an upward trend (+18 pp in 14 years); in poorer countries, the *AGIR* displays a downward trend (-8 pp). In the next subsection, we will show that our results (i) do not depend on our binary country-group classification but that there is a statistically significant trend component that varies with the initial country-specific GDP level, and (ii) hold when considering the unbalanced dataset with years, rather than waves, as the unit of observation. Third, the age-earnings gap grew by only 8 pp in richer countries. Hence, the age-earnings gap grew less than the overall age-income gap.[8] These findings lead to our first novel stylized fact.

Stylized fact 1 In the last 20 years, the *AGIR* has evolved in opposite directions in richer and poorer countries: in the former, the *AGIR* has risen by around 18 percent, while in the latter economies, it has declined by around 8 percent. Also, those trends for the *AGIR* are more divergent than for the age-earnings gap.

3.1.1 Trends: statistical significance

We now statistically corroborate the illustrative evidence of diverging trends in *AGIR* between richer and poorer economies. Specifically, we first perform the following regression:

$$log(R_{i,t}) = \alpha + \tilde{\alpha}\mathbb{1}_i^d + \beta t + \tilde{\beta}(\mathbb{1}_i^d \times t) + \varepsilon_{i,t}. \tag{2}$$

Here, $R_{i,t}$ denotes the *AGIR* computed for the age groups 50-64 and 25-34, i denotes the country index, $\mathbb{1}_i^d$ is a dummy variable that takes the value of 1 if country i belongs to the richer group and 0 otherwise, The time variable t takes values in $[0, 3, 6, 9, 12]$ when we consider wave observations and values in $[0, 1, 2, \ldots, 14]$ when we consider annual

[8]See Appendix B.1 for the statistical evidence.

observations.[9] Accordingly, α represents the average value of $\log(AGIR)$ at the beginning of the 2000s in poorer countries, $\tilde{\alpha}$ is the additional initial average $\log(AGIR)$ for the richer countries, β is the average time trend in poorer countries, and $\tilde{\beta}$ is the additional time-slope for richer countries.

Columns (1) and (3) of Table I report the results of our regressions for waves and years, respectively. The *AGIR* in the poorer and richer countries are not statistically different at the beginning of the sample but follow opposite trends. In fact, in poorer countries, the *AGIR* time trend is negative (-0.4 percent per year) but not significant, while it is strongly positive (+1.4 percent per year) in richer countries.

These results do not depend on our binary classification of "richer" and "poorer" countries. We perform the same analysis while relaxing this rigid division, estimating the relationship between the initial log-GDP level and the magnitude of the *AGIR*'s initial level and trend. For this purpose, we run the following regression:

$$log(R_{i,t}) = \alpha + \theta\overline{GDP}_{i,0} + \beta t + \gamma(\overline{GDP}_{i,0} \times t) + \varepsilon_{i,t} \tag{3}$$

Here, $\overline{GDP}_{i,0}$ denotes the deviation of the log-GDP for each country in 2004 from the cross-section sample mean. Accordingly, α represents the beginning-of-sample $\log(AGIR)$ for a country with initial log-GDP equal to the cross-section mean, θ is the elasticity of *AGIR* to a change in initial GDP, β is the *AGIR* time-trend for a country with initial log-GDP equal to the cross-section mean, and γ is the additional slope of the time trend correlated to cross-country variation of initial GDP.

Columns (2) and (4) of Table I report the estimates for waves and years. The beginning of sample *AGIR* for a country with average initial GDP was around 1.13, and the correlation between initial *AGIR* and initial GDP level is slightly positive but not significant. Looking at the time trend, we find that a country with average GDP experienced a small increase in *AGIR* over the period (β). The trend was stronger for countries with higher GDP than the mean and weaker, or even negative, for those poorer than the mean (positive γ). The last four rows of the Table report the estimated time trend at different points of the GDP distribution. When moving from the poorest to the richest countries

[9] This allows the coefficients on the time trends to be comparable across wave and year specifications.

in our dataset, the time trend of $AGIR$ grows monotonically from -0.6 percent per year to +1.3 percent per year.

TABLE I. Trend in AGIR

	Wave		Year	
Dependent	ln(AGIR)			
	(1)	(2)	(3)	(4)
[1] β: Trend	-0.004	0.006**	-0.008**	0.005***
	(0.005)	(0.003)	(0.003)	(0.002)
[2] $\tilde{\beta}$: Trend × Richer	0.018***		0.021***	
	(0.006)		(0.004)	
[3] $\tilde{\alpha}$: Richer	0.031		-0.017	
	(0.044)		(0.034)	
[4] θ: Initial log-GDP (Dev)		0.007		-0.027
		(0.020)		(0.020)
[5] γ: Trend × Initial log-GDP(Dev)		0.009***		0.015***
		(0.003)		(0.002)
Observations	158	158	357	357
R^2	0.274	0.200	0.281	0.206
F-Test:[1]+[2]=0 or [1]+[5]=0	22.77	21.55	57.19	71.39
Trend effect at min GDP		-0.006		-0.016***
Trend effect at 25% GDP		0.002		-0.002
Trend effect at 75% GDP		0.010***		0.012***
Trend effect at max GDP		0.013***		0.017***

Notes: Significance level: * = 0.05, ** = 0.01, *** = 0.001. Standard errors and heteroscedasticity-robust and corrected for the degrees of freedom. Columns (1) and (3) report the estimates of Equation (2) for wave and yearly observations, respectively. Columns (2) and (4) report the estimates of Equation (3). The last four rows illustrate the implied trend effect at different quantiles of GDP.

In the next sections, we study the determinants of the growth in $AGIR$, and explain why its dynamics differ from those of statistics based on the earnings of employees.

3.2 Income determinants of age inequalities

In this section, we examine which subcomponent of income played the primary role in shaping the dynamics of the $AGIR$. We focus on the changes in $AGIR$ between the beginning to the end of the sample period, as it displays a clear overall trend over the last two decades with no cyclical fluctuations.

Consider the average disposable income for a specific age group j at a given period t, denoted by $y_{j,t}$. The country i's age group j's income growth rate between period T_i and

$T_i + h_i$ is:

$$g_i(y_j) = \frac{y_{j,T_i+h_i}}{y_{j,T_i}} - 1,$$

where $y_{j,T}$ denotes average income in period T for age group j. Let us drop the country index, i, for the sake of notation. Then, we define as Growth Rate Differential (GRD) the difference of the annualized growth rates of the income of old and young individuals, i.e. $g(y_{\text{old}}) - g(y_{\text{young}})$. This statistic has two advantages. First, it approximates the growth rate of the $AGIR$:[10]

$$GRD \equiv \frac{1}{h}\left(g(y_{\text{old}}) - g(y_{\text{young}})\right) \approx \frac{1}{h}\frac{R(T+h) - R(T)}{R(T)}.$$

Second, it allows us to perform an exact growth accounting to investigate the sources of these growth rate differentials between late- and early-career age groups and, consequently, of the trend of $AGIR$. Specifically, we exploit the degree of details of the LIS dataset to decompose the GRD into the contribution of the intensive and extensive margins of labor and non-labor income.

In Figure 2a, we display the annualized difference between the two age groups' income growth rates. Consistently with the evidence provided about the evolution of the $AGIR$, the GRD are positive for all rich countries except for the US and negative for most poorer economies. For 27 out of 32 countries, the GRD are statistically different from zero. Notably, the US has one of the highest $AGIR$ in our sample but it has not grown over the last 20 years.

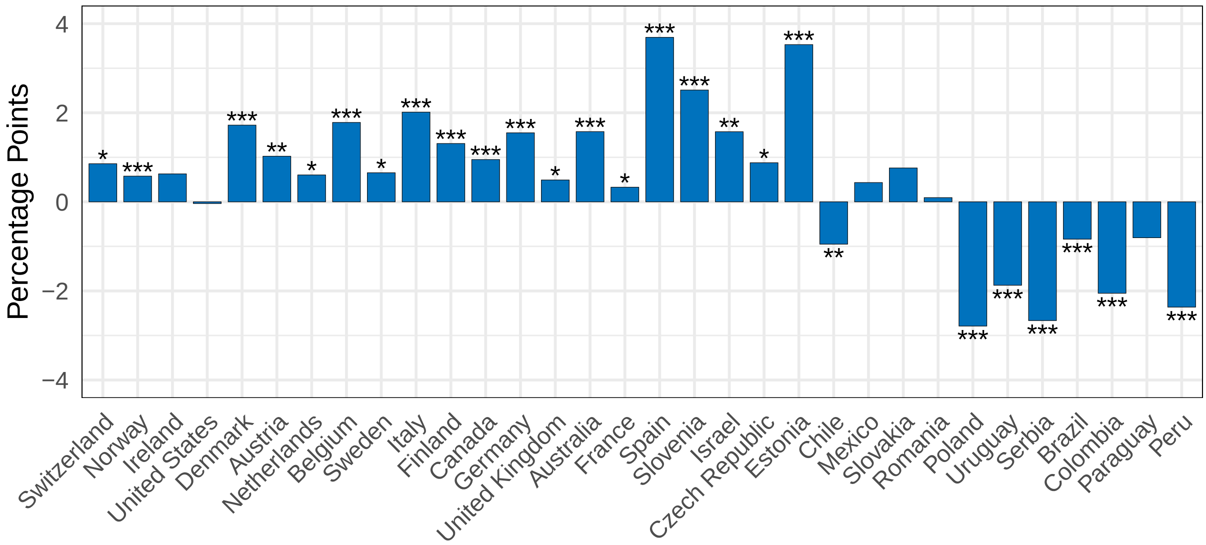
In Figure 2b we display the growth rates of income of young and old for each country. In most richer countries, the average income of young individuals has either fallen or remained approximately stationary between 2004 and 2018, while the income of the old grew at moderate rates. On the other hand, the negative GRD in poorer countries has arisen from a fast growth of income for both young and older individuals, although somewhat larger for the young.

We now turn to studying what income component caused these patterns in GRDs. Starting from the observed individual disposable income, defined in equation (1), and ignoring time and country indices, we can write the country *average* disposable income,

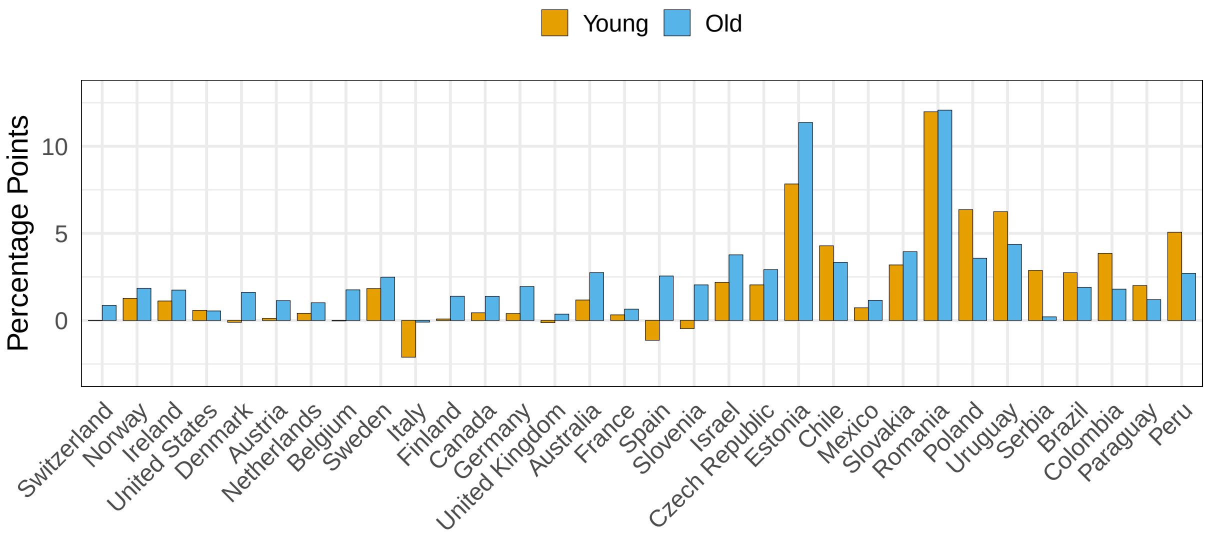
[10] See Appendix C.1 for the derivation.

Figure 2. Income growth rate differentials: early-career and late-career

(a) Growth Rate Differentials



(b) Growth Rate of Real Income, annualized



Notes: panel (a) depicts the Growth Rate Differentials (GRD), defined as the difference between the annualized income growth between 2004 and 2018 of late-career individuals (50-64 y.o., "old") and early-career individuals (25-34 y.o., "young"), by country. The stars indicate whether the GRD is statistically different from zero. Significance level: * = 0.05, ** = 0.01, *** = 0.001. Panel (b) plots the annualized income growth figures behind the calculation on the GRD, by country and age group.

y as:

$$y = ey^n + p\Theta^n,$$

where y^n denotes average labor earning, i.e. labor income conditional on being employed, e is the share of employed individuals, p denotes the share of individuals receiving any transfer, and Θ^n denotes the average amount of net transfers conditional on receiving a non-zero value.

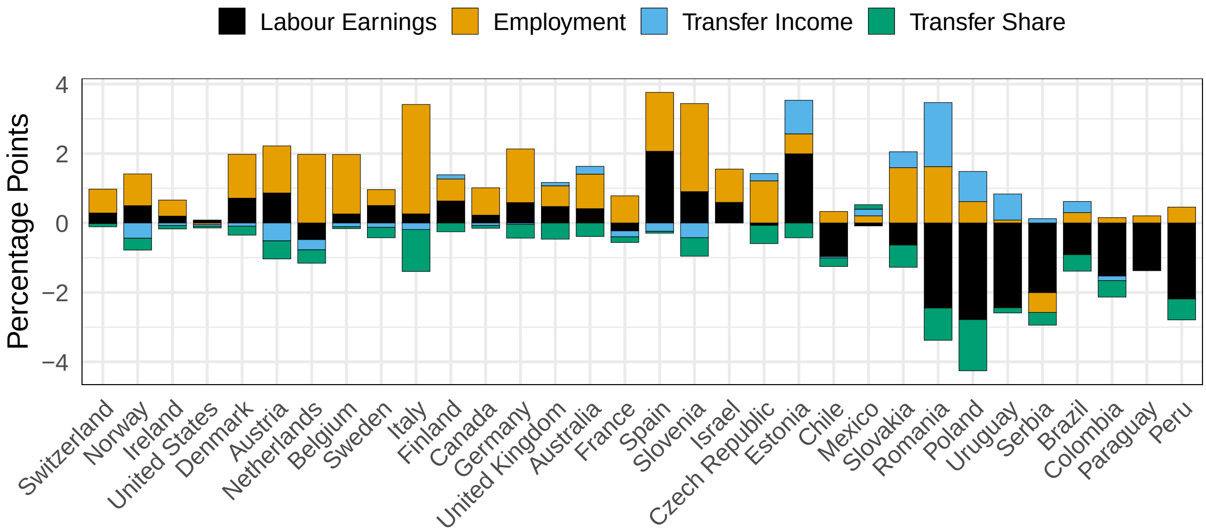
Then, the *growth rate* of average disposable income of age group j between period T and $T + h$ is:

$$\frac{\Delta y_j}{y_{j,T}} = \underbrace{\frac{e_{j,T}\Delta y_j^n}{y_{j,T}}}_{\text{Labor Earnings}} + \underbrace{\frac{y_{j,T}^n\Delta e_j}{y_{j,T}}}_{\text{Employment}} + \underbrace{\frac{p_{j,T}\Delta\Theta_j^n}{y_{j,T}}}_{\text{Transfer Income}} + \underbrace{\frac{\Theta_{j,T}^n\Delta p_j}{y_{j,T}}}_{\text{Transfer Share}}, \tag{4}$$

where Δx denotes the difference of variable x between periods T and $T + h$. All income components are considered net of taxes. Then, we can decompose the *GRD* into the contributions of the difference, between old and young, of each of the income growth margins depicted in equation (4), by computing the four components of the difference $\frac{\Delta y_{old}}{y_{old,T}} - \frac{\Delta y_{young}}{y_{young,T}}$.

Figure 3 illustrates these contributions: a positive value means that the specific sub-components contributed to faster income growth for the 50-64 age group than for the 25-34 one. We now describe the main findings, focusing on each component at a time.

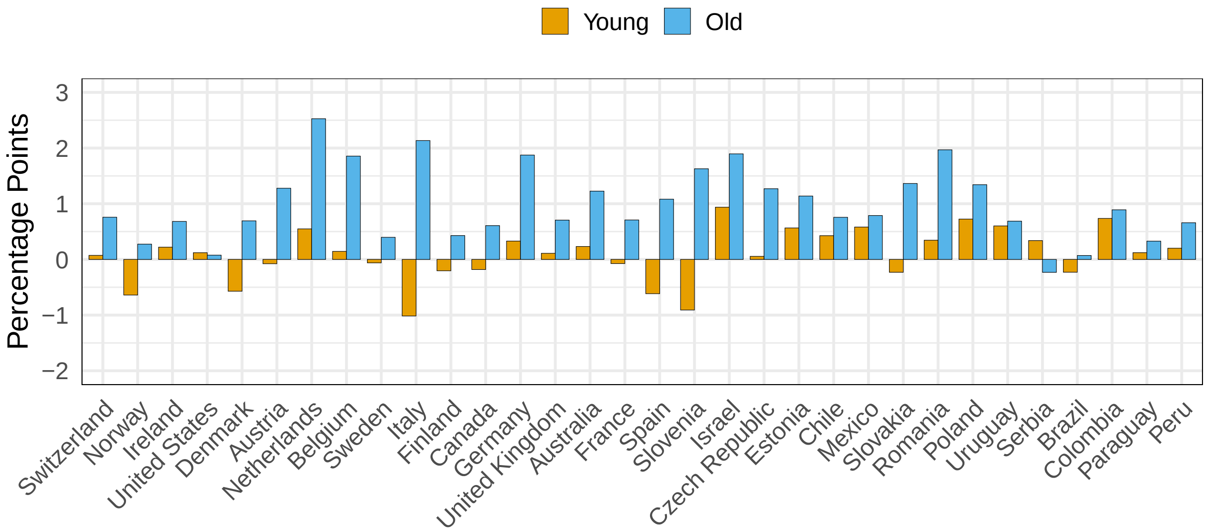
Figure 3. *GRD* Decomposition, by income components



Notes: The figure depicts the decomposition of the Growth Rate Differential (*GRD*) calculated for disposable income, comparing late-career individuals (50-64 y.o.) with early-career individuals (25-34 y.o). "Labor earnings" refers to the contribution to the *GRD* of differences in growth of the average labor earnings received, conditional on being employed. "Employment" refers to the contribution toward the total *GRD* of differences in employment rate growth. "Transfer Income" refers to the contribution of differences in growth of the average transfer received, conditional on receiving one. "Transfer Share" refers to the contribution of differences in the growth of the share of individuals receiving a transfer.

Employment. In rich countries, the main contributor to the unequal income growth between late- and early-career individuals is the employment margin, a consequence of the divergence in employment rates across the two age groups. In fact, in Figure 4 we show that while the employment margin did not contribute to the growth the income of early-career individuals (or even negatively so for some countries), the employment margin of late-career individuals provided a substantial contribution to their income growth, between 0.5 and 2 percentage points per year. As a result, the contribution of the employment margin to the *GRD* in rich countries is 1.2 pp. On the contrary, the employment margin is sensibly smaller in poorer countries (average contribution of 0.5 pp). This is due to the young's employment margin component being positive and almost as large as the old's one.

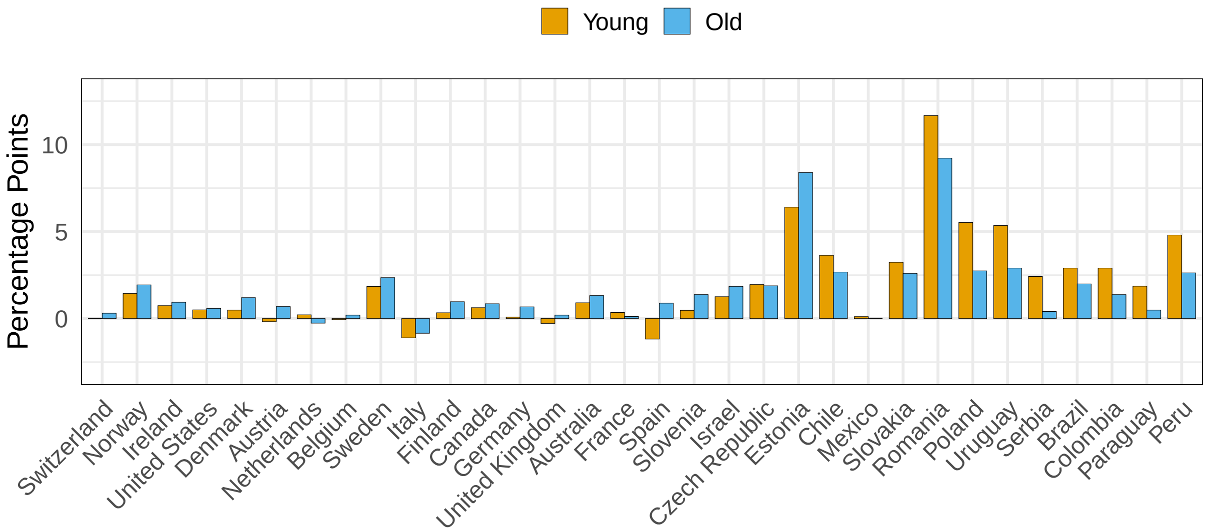
Figure 4. Employment margin of income growth rate



Notes: The figure depicts the employment margin of the Growth Rate Differential for late-career individuals (50-64 y.o., "old") and early-career individuals (25-34 y.o., "young"), by country. The employment margin captures the contribution to the (annualized) real income growth of an age group arising from changes in the average employment rate. Hence, an employment margin of 1% implies that changes in employment rates contributed towards total income growth by 1 percentage point per year between 2004 and 2018.

Labor Earnings. Labor earnings also contributed positively to the faster rise in the income of late-career workers in most richer countries, implying that the wage growth of late-career workers has outperformed that of early-career workers. Notice that this component reflects the dynamics of the age-*earnings* gap, which is studied by (Bianchi et al., 2022; Bianchi and Paradisi, 2024; Bennett and Levinthal, 2017; Beaudry et al., 2014). However, unlike the age-earnings gap, its relative size across countries is also affected by employment rates and by the importance of labor income for the overall disposable income of an age group. Our decomposition highlights that, in richer countries, the earnings margin is not the main driver of the overall evolution of the $AGIR$ (average of 0.5 pp across rich countries). On the contrary, in poorer economies, the younger age group has experienced much faster earnings growth than the older age group (average contribution to GDR equal to -1.3 pp). This margin explains virtually all the fall in $AGIR$ in low-income countries and contributed negatively also in countries with an overall positive GRD (such as Mexico, Slovakia, and Romania). In Figure 5 we plot each age group's earnings component.

Figure 5. Labor earnings margin of income growth rates



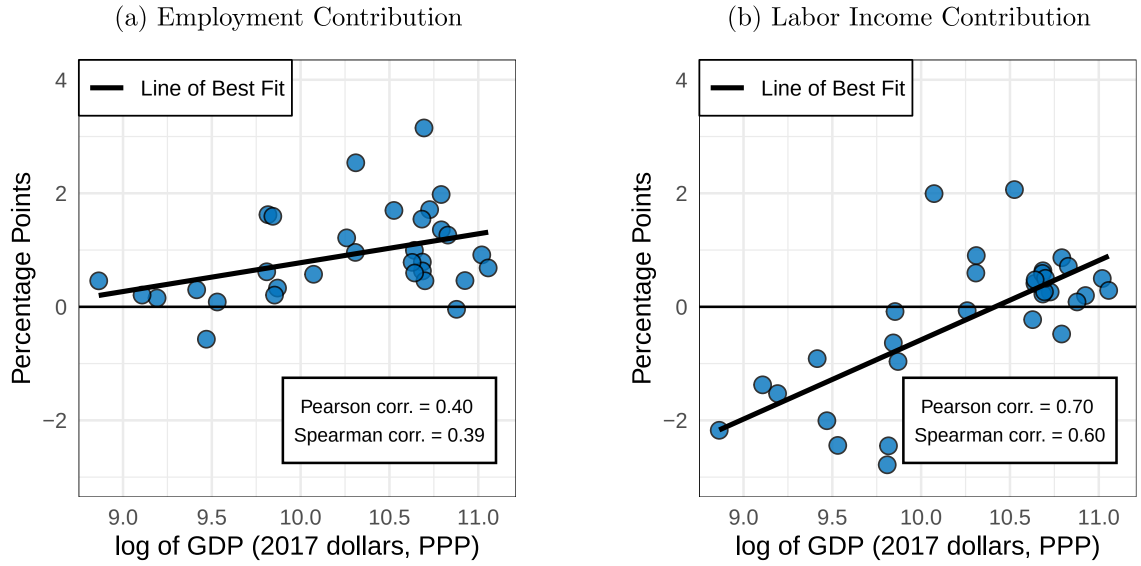
Notes: The figure depicts the earnings margin of the Growth Rate Differential for late-career individuals (50-64 y.o., "old") and early-career individuals (25-34 y.o., "young"), by country. The earning margin captures the contribution to the (annualized) real income growth of an age group arising from changes in the average labour earnings of employed individuals. Hence, an earning margin of 1% implies that changes in average wages contributed towards total income growth by 1 percentage point per year between 2004 and 2018.

Pensions and Transfers. For most countries, pension and welfare payment changes had little impact on the *GRD*. However, we can observe some common patterns. In most countries, the share of old-age individuals receiving transfers has fallen slightly faster than the young, implying a negative transfer share margin (average -0.4 pp; -0.3 in the richer countries and -0.5 in the poorer ones.). The contribution of changes in the transfers' size ("Transfer Income" margin) is more heterogeneous, being mostly small and negative in richer countries (average of -0.1 pp) but fairly large and positive for the poorer ones (average of 0.5 pp).

We provide visual evidence for the relationships between GDP levels and the two labor market margins of the *GRD* (employment and labor earnings). In Figure 6 we plot the per capita PPP GDP (in 2017 US dollars, in log) of each country at the beginning of the sample against the employment margin (panel a), and labor earning margin (panel b). Using the same scale, a reader can immediately evaluate the relative contributions of the two components to the *GRD*. Notice that the employment margin is positive for almost all countries, although small for poorer and large for richer countries. On the contrary, the labor earnings margin flips sign across the GDP distribution, being large and negative for poorer economies and positive but close to zero for most richer ones.

These observations lead to our main stylized fact.

Figure 6. Employment and Labor Income Contribution to *GRD* vs GDP level



Notes: Panel (a) plots the employment margin of the *GRD* against the log of PPP GDP (calculated at 2017 dollars in 2004). In the box, we present the two variables' linear correlation (ρ). Panel (b) plots the labor earnings margin of the *GRD* against the log of PPP GDP (calculated at 2017 dollars in 2004). Other specifics are as in panel (a).

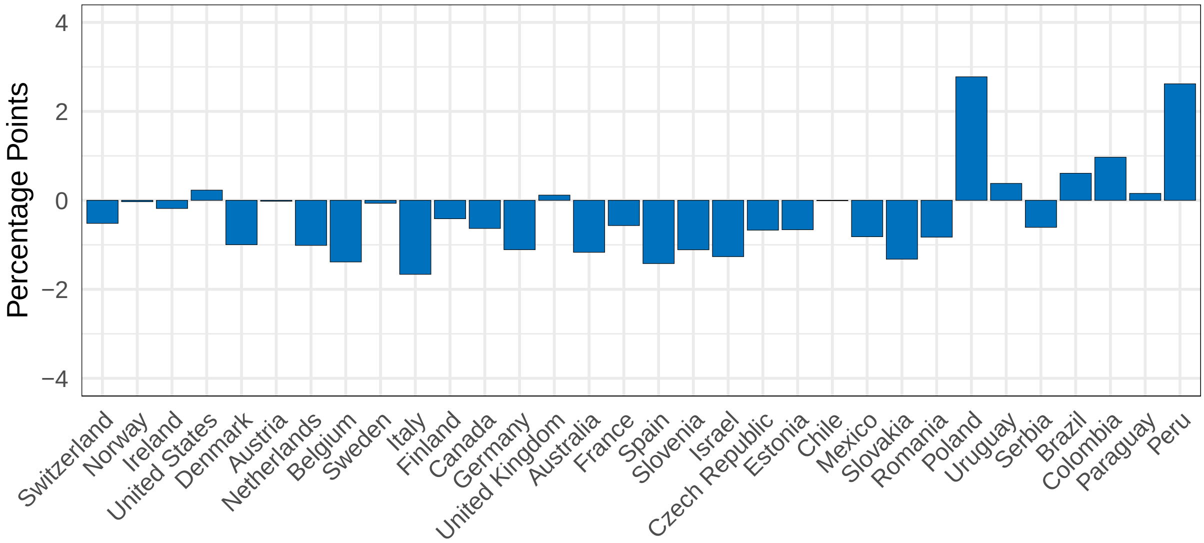
Stylized fact 2. In rich countries, the main contributor to the positive *GRD* is the divergence in employment rates between young and old. In lower-income countries, the main contributor to negative *GRD* is the faster increase in labor income, conditional on being employed, of the young relative to the old.

This stylized result can also help understand why the age-earnings gap has grown, in absolute terms, less than the age-income gap. Although the earnings of the old have increased faster than those of the young in rich countries, the employment margin provided a larger contribution. Hence, the age-income gap has increased faster than the age-earnings gap in rich countries. Conversely, the considerably higher employment rate among the young (relative to the old) in poorer countries amplified the effects of changes in the earnings margin.[11] Hence, the fall in *AGIR* is larger than in the age-earnings gap. In Figure 7, we depict these differences between the *GRD* of the labor earnings (including both employees' wages and self-employed labour earnings) of employed individuals and

[11]Consider how even with an identical wage growth across age groups, the overall disposable income would increase more for the age group with more employed individuals, everything else equal.

the income of all individuals. A negative number means that the GRD of income is larger than that one of earnings. The consistent negative bias in richer countries (where GRDs are positive) and positive bias in many poorer countries (where GRDs are negative) highlights how earning gaps have changed less than income gaps. In richer countries, the age-income gap has grown twice as fast as the age-earnings gap.

Figure 7. Difference between GRD of earnings and income



Notes: the figure depicts, for each country, the difference between the annualized GRD of the labor earnings of employed individuals and the annualized GRD of disposable income of all individuals. A negative value means that the latter was larger than the former, implying that age inequalities grew faster (or fell less) for disposable income than labour earnings.

Take away These results are relevant for two reasons. First, we have highlighted that the drivers of changes in the age-income gap differ between high-income and lower-income countries but are similar within income groups (employment rates in the former, earnings in the latter). These patterns justify the global scope of our analysis and uncover the rise in age-income gaps as a common problem in most high-income countries. Second, these patterns suggest that the causes of the rise in $AGIR$ in richer economies should be explored by looking at phenomena connected to the long-run trends that might have affected labor force participation at the later stage of the working career. We investigate this intuition in the next section.

4 Demographic trends and age-income gaps

Could the large increased $AGIR$ and the relevance of the employment margin in richer countries be attributed to specific long-run trends occurred in recent decades? We first display evidence of three important trends in industrialized economies in our data: (1) increased education achievement (Goldin and Katz, 2007, 2018a); (2) increased female labor force participation (Costa, 2000; Olivetti and Petrongolo, 2016; Goldin and Katz, 2018b); (3) increased minimum pension age (Pilipiec et al., 2021; Staubli and Zweimüller, 2013). We show how these trends had different impacts on young and old, and thus are candidates to explain the observed changes in the age-income gap.[12]

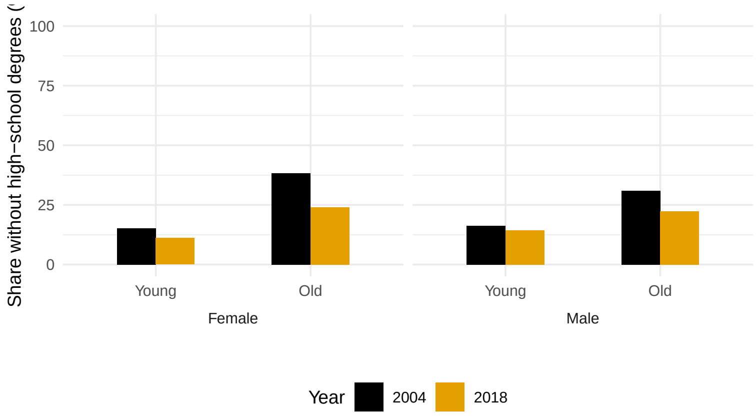
4.1 Evidence of long run trends

Education Convergence Figure 8 illustrates the evolution of education achievement by gender and age group from 2006 to 2018, averaged across rich countries. Two key takeaways underscore the uneven impact of this long-term trend across different age groups. First, the proportion of young workers with college degrees in rich countries has steadily increased over time (from 35% to 44%), primarily driven by a decline in the share of young workers with only a high school diploma (from 49% to 40%). Second, while the proportion of older workers with college degrees has also risen over the years (from 24% to 33%), in this case, the shift is largely due to a significant reduction in the share of older workers without a high school education (from 41% to 23%). Since (i) there is a large pay gap between non-high school educated and high-school (or more) educated workers; (ii) old workers with college degrees tend to earn more than young workers with the same degree because of the return to experience; and (iii) more educated individuals are more likely to be employed for longer, these trends in education achievement might have a large impact on overall income divergence across age groups.

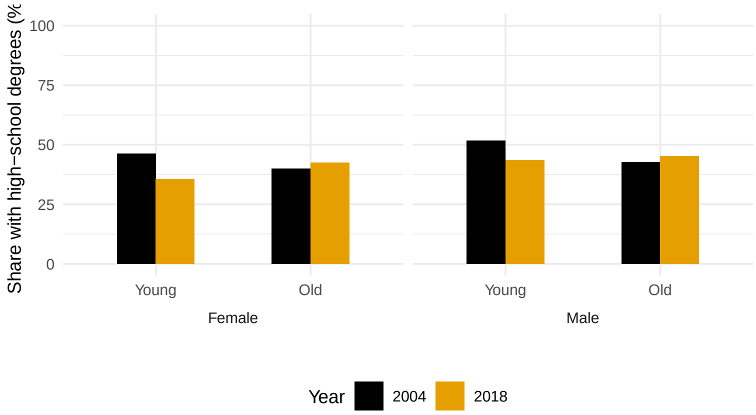
[12] In Appendix D.2, we provide additional results on the country-level GRD across sex, education, and for individuals above and below the minimum retirement age.

Figure 8. Evolution of Education Rate by Gender and Age-Group

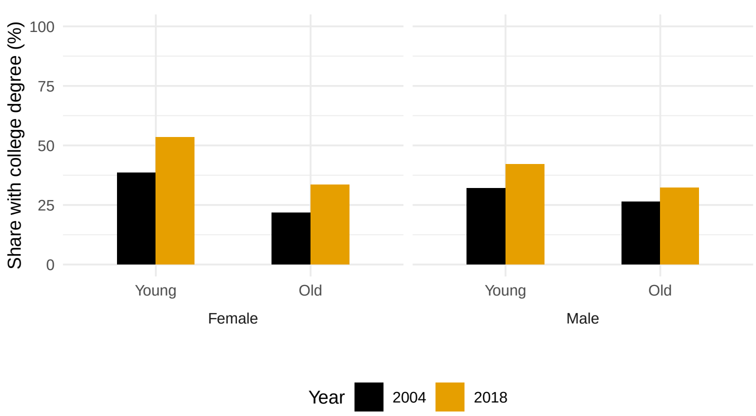
(a) No High-School



(b) High-School



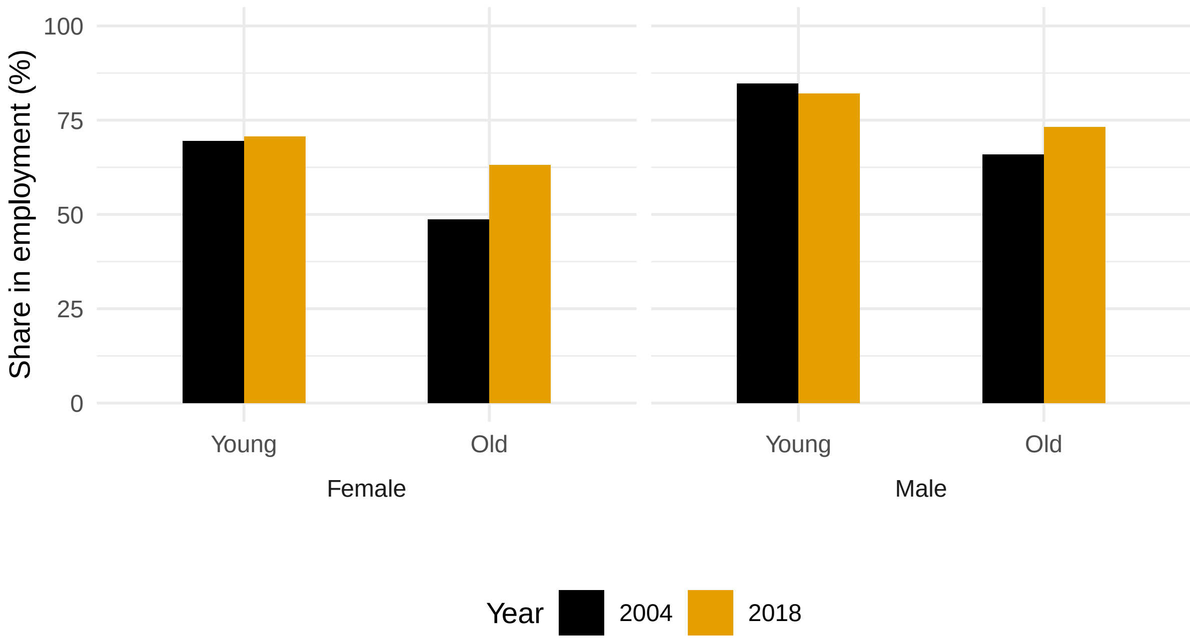
(c) College



Notes: the figure depicts the simple mean across all countries in the "richer" group of the share of individuals whose educational attainment was at most less than high-school (panel a), an high-school degree (panel b), or college and other post-secondary education (panel c). The shares are reported separately for the young (25-34 y.o.) and old (50-64 y.o.), female and male. The black bar refers to the share in the first year of observation (between 2004 and 2006), while the orange bar refers to the share in the last year of observation (between 2016 and 2018).

Increased Female Labor Force Participation Figure 9 displays the evolution of employment rate by gender and age-group from 2006 to 2018, as an average for the rich countries. The employment rate has dramatically increased for old-workers, and more so for females. In fact, the old workers' employment rate increased from 57% in 2004 to 68% in 2018 (from 48.6% to 63.2% for females and from 66.0% to 73.2% for males). In contrast, young workers' employment rate slightly decreased from 77.1% to 76.4%. Therefore, the first two decades of the new millennium were characterized by a quick convergence of employment rates for old workers to the ones of young workers, with a considerable increase in employment among old females (+14.6 pp).

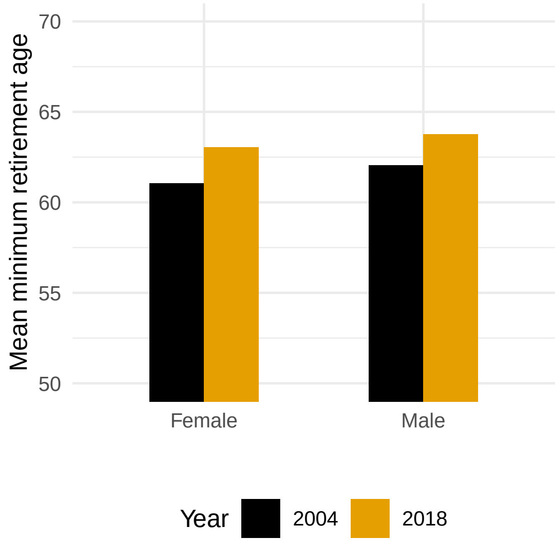
Figure 9. Evolution of Employment Rate by Gender and Age-Group



Notes: the figure depicts the simple mean across all countries in the "richer" group of the share of employed individuals. The shares are reported separately for the young (25-34 y.o.) and old (50-64 y.o.), female and male. The black bar refers to the share in the first year of observation (between 2004 and 2006), while the orange bar refers to the share in the last year of observation (between 2016 and 2018).

Ageing and changes in minimum pension age Finally, one of the possible reasons why employment among old generations has considerably increased between 2004 and 2018 is the increase in retirement age. Not only have some countries implemented pension reforms mandating longer working lives, but the shift away from physically-intensive jobs and the improvement in healthcare may have incentivised old workers to delay retirement further. In Figure 10, we display how the average minimum retirement age in rich countries has increased from 62.1 to 63.8 for males and from 61.1 to 63.1 for females between 2004 and 2018, meaning that up to an additional 12% of individuals in the 50-64 age group could not legally retire in 2018, relative to 2004.[13]

Figure 10. Evolution of Minimum Pension Age by Gender



Notes: the figure depicts the simple mean across all countries in the "richer" group of the average minimum retirement age, by gender.

4.2 Isolating the role of the long-run trends

This section aims to isolate the role of those long-run trends for the increased $AGIR$ and for its main drivers, i.e., employment and earning margins. For this purpose, we run three counterfactual exercises.

Counterfactual 1: Shutting down education convergence In the first counterfactual, we shut down the education convergence trend. Specifically, we recompute the GRD for each country, assuming that the education rates in 2018 are identical to those in 2004 for all the combinations of males, females, and young and old workers in that country. Column *CF1-Education* in Table II presents the results. Under this counterfactual scenario, the average GRD in rich countries drops from 1.18 to 0.80, a 25 percent reduction. Intuitively, in this counterfactual, a larger share of older workers have no college, and a smaller share have college degrees. This counterfactual education shift reduces the old's 2018 income not only because college-educated individuals have, on average, a higher income than non-college-educated ones but also because they are much more likely

[13] We describe the data sources in Appendix D.1. Notice that our measure of minimum retirement age does not capture the presence of special exceptions to retirement based on occupational, health, or special conditions. Hence, there can be individuals who can retire earlier than the official minimum age.

to be employed (55% vs 77% for males and 34% vs 67% for females). This counterfactual also penalizes young workers, but to a lower extent, since the young's differences in wages and employment rates are smaller across education groups are smaller than the old's. Therefore, the counterfactual scenario yields a smaller difference in the income growth of old (more penalized) and young (less penalized), mainly driven by a smaller increase in employment rates among the old. For this reason, most of the change in *GRD* (-0.3 percentage points) comes from a smaller employment margin (-0.2 percentage points).

Counterfactual 2: Shutting down the increase in female participation In the second counterfactual, we shut down increased female labour force participation among older individuals. Specifically, we recompute the *GRD* for each country, assuming that the gap between old and young female employment rates followed the same trend as the male gap. Thus, the counterfactual female employment rate in 2018, denoted $e^{\text{CF,female}}_{2018,\text{old}}$, equals to:

$$e^{\text{CF,female}}_{2018,\text{old}} = e^{\text{female}}_{2004,\text{old}} + \underbrace{(e^{\text{female}}_{2018,\text{young}} - e^{\text{female}}_{2004,\text{young}})}_{\Delta\text{ Young female employment}} + \underbrace{\left[(e^{\text{male}}_{2018,\text{old}} - e^{\text{male}}_{2018,\text{young}}) - (e^{\text{male}}_{2004,\text{old}} - e^{\text{male}}_{2004,\text{young}})\right]}_{\Delta\text{ Old-Young male employment gap}}.$$

Column *CF2-Female Emp.* in Table II presents the results. In this counterfactual scenario, the average *GRD* across rich countries falls slightly from 1.18 to 1.14, a 3.3 percent reduction. In this counterfactual, older female workers have a lower employment rate than observed, as employment for old female workers has grown faster than for males. However, the difference is small because the *gap* between old and young females has changed in a very similar way to the gap between old and young males. While the employment of older females has grown considerably more than that of older males, a similar gender gap is observed for their younger counterparts. Hence, in our counterfactual, the change in female employment rates is only slightly negative.

Counterfactual 3: Shutting down both channels These two margins are not orthogonal. By shutting them down at the same time we can compute their overal contribute on the *GRD* in rich counties. Column *CF3-Both* displays the results. These two channels alone account for 28 percent of the average *GRD* in rich economies, which approximates the increase in AGIR from 2004 to 2018.

TABLE II. Counterfactual results, individuals

	Data	CF1 - Education	CF2 - Female Emp.	CF3 - Both
GRD	1.18	0.88	1.14	0.85
	Change	-0.30	-0.04	-0.33
Employment Margin	1.18	0.98	1.16	0.98
	Change	-0.20	-0.02	-0.20
Labor Earnings Margin	0.35	0.31	0.33	0.30
	Change	-0.03	-0.01	-0.05

Notes: the "Data" column shows the GRD, the employment margin of the GRD, and the wage margin of the GRD as calculated from the data. All figures are in annualised percentage points. The CF1 column shows the corresponding counterfactual figures when we assume that education achievement was unchanged, across age groups and genders, between 2004 and 2018. The CF2 column shows the corresponding counterfactual figures when we assume the gap between the young and old employment rates followed the same trends across genders (so that the 2018 employment of old females is equal to its 2004 values, plus the 2004-2018 change in young female employment, plus the 2004-2018 change in the gap between old and young male employment), by education group. The last column shows the corresponding counterfactual figures when the assumptions of the two previous counterfactual are put together. The "Change" row show the difference between a column's figure and the "Data" one.

Counterfactual 4: Shutting down increased minimum pension age Finally, we investigate whether the large employment margin of $AGIR$ is mainly due to a delay in retirement (Pilipiec et al., 2021; Staubli and Zweimüller, 2013). How did the changes in minimum pension age affect $AGIR$, and how did they interact with the two other channels presented above? To answer this question, we restrict our sample to individuals below the lower minimum pension age observed in the period 2004-2018, i.e. age $\leq min\,(MPA_t)$, where MPA_t denotes the minimum pension age (by gender) in year t.[14] This restriction implies an alternative definition for the old age group that aims to insulate our statistics from changes in the minimum age threshold for old-age retirement and ageing (as it changes the relative composition of old individuals above or below the retirement age).[15] Moreover, it allows us to exclude individuals who, given their age, were allowed to retire in both years (being above the 2018 minimum retirement age) but whose retirement incentives may have changed between 2004 and 2018 due to other labour market and policy changes we cannot capture by looking at pension age thresholds.

Table III presents the result with this alternative definition of the old age group. First, notice that with this alternative definition of the old, the average GDR in rich

[14] See Appendix D.1 for the full description and data source.

[15] It turns out that the lower minimum pension age throughout our sample is the one in 2004, regardless of gender, because, in none of the countries in our sample, it declined between 2004 and 2018.

countries is slightly higher (1.21) than the baseline figure (1.18). This means that the increased pension age is not the main reason we observe an increase in $AGIR$ between the two periods. However, the components determining the aggregate GRD differ somewhat. Employment trends increased age-income inequalities by 1.08 pp. per year (1.18 in the full sample), while earnings trends contributed to 0.42 pp. (0.35 in the full sample). This divergence suggests that while part of the GRD came from a change in the retirement behaviour above the minimum pension age, this was not the main contributor to the positive employment margin we observe in richer countries. This implies that the increase in our measure of age-income inequalities was not caused by policies that may mechanically increase today's age-income inequalities, while improving the long-term intergenerational fairness of the pension system.

Next, we perform the same counterfactual exercises on education and female labour force participation we run for the overall population on this restricted sample. We obtain similar estimates for the role of education convergence (shutting down this channel reduces the GRD by 33 percent), while the role of the trends in female labour force participation slightly increases (reducing the GRD by 12 percent). Both counterfactuals explain 42 percent of the GRD in this subsample, against 33 percent in the full sample. This result suggests that increased female labour force participation has been somewhat important for the increase in age-income gaps. However, participation in the older-age male labour force also substantially increased among those above the minimum pension age. Overall, these counterfactuals highlight that the importance of education convergence of the older age group is quite substantial, irrespective of whether we include or exclude individuals who would have been more likely to retire under the 2004 retirement rules.

TABLE III. Counterfactual results, individuals below 2004 pension age

	Data	CF1 - Education	CF2 - Female Emp.	CF3 - Both
GRD	1.21	0.88	1.10	0.79
	Change	-0.33	-0.12	-0.42
Employment Margin	1.08	0.89	0.96	0.80
	Change	-0.19	-0.12	-0.29
Labor Earnings Margin	0.42	0.34	0.41	0.33
	Change	-0.08	-0.00	-0.09

Notes: the "Data" column shows the *GRD*, the employment margin of the *GRD*, and the wage margin of the *GRD* as calculated from the data when restricting the category of old workers to be of age lower than the minimum retirement age observed in the period 2004-2018, by gender, for each country. All figures are in annualised percentage points. The CF1 column shows the corresponding counterfactual figures when we assume that education achievement was unchanged, across age groups and genders, between 2004 and 2018. The CF2 column shows the corresponding counterfactual figures when we assume the gap between the young and old employment rates followed the same trends across genders (so that the 2018 employment of old females is equal to its 2004 values, plus the 2004-2018 change in young female employment, plus the 2004-2018 change in the gap between old and young male employment), by education group. The last column shows the corresponding counterfactual figures when the assumptions of the two previous counterfactual are put together. The "Change" row show the difference between a column's figure and the "Data" one.

Our analysis suggests the following third stylized fact:

Stylized fact 3. Changes in education level of the old age group is a large driver of the increased $AGIR$, accounting alone for more than 33 percent of its increase. Female labour force participation had a smaller role (between 4 and 12 percent), while changes in the retirement age is not the main driver.

4.3 $AGIR$ at full convergence in rich countries

What are the prospects of future $AGIR$ in rich countries if (or when) the education achievements of young and old generations were to converge and the gender-employment gap close? We can compute the hypothetical $AGIR$ in this possible future scenario with a simple back-to-the-envelope calculation. Specifically, we assume that the education rate of the old equalizes the one of the young for each gender and that the employment rates of females equalize the ones of the males for each age and education group, keeping everything else equal. We find that $AGIR$ would increase even further, going from 1.31 as measured in 2018 to a counterfactual value of 1.43, on average, among richer countries. The increase would be more pronounced in certain countries, with estimated peaks reaching 1.98 in Spain and 2.07 in Italy (1.64 and 1.71 in 2018, respectively). These projections highlight the pressing need for policymakers to address the long-term impact of these trends on generational fairness. If left unaddressed, the widening income gap could weaken intergenerational cohesion and create a situation where younger generations experience consistently fewer economic opportunities than older ones. This analysis underscores the importance of implementing balanced policies that respond to demographic changes and encourage equitable income distribution across different age groups.

5 Conclusions

The growth of inequalities between young and old individuals has become a prominent topic in several advanced economies' media and political discourse. Yet, most of the existing evidence has focused on labor earnings of people in employment (rather than the income of all individuals) and a small set of developed countries. In this paper, we overcome these limitations by studying the evolution of age inequalities in disposable income (thus covering all individuals and non-labor income sources) for 32 countries at different ends of the development spectrum. We uncover three novel results.

First, the age-income gap has increased in richer countries (Western Europe, North America, Oceania) but has fallen in poorer countries (Eastern Europe, South America).Second, we find that the main driver of the increase in $AGIR$ in richer countries is the change in the relative employment rate of old and young individuals in favor of the former. In contrast, the fall in $AGIR$ in poorer countries came from the faster increase in labor earnings of the young relative to the old. Finally, we show that accounting for some of the most important long-run demographic trends of recent decades (increase in female labor force participation, increase in the education level of older generations, harsher retirement policies as an answer to population aging) explain around one third of the growth of $AGIR$ in richer countries, mainly through the employment channel. Increases in the average educational attainment of older generations, as more educated cohorts aged over time, are the largest contributor to the overall increase in $AGIR$ in richer countries. These results imply that a considerable share of the increase in age inequalities has been due to long-run cohort effects common to most countries, which are unlikely to revert. If anything, most countries may be headed for a higher *level* of age inequalities in the process of full education and employment convergence between old and young workers. Our results open new research questions. Commonly studied demographic trends cannot fully explain the role of the employment margin. Does this imply there have been *other* age-biased structural changes in the organization of labor and demand for skills in favor of the old? Or is it due to friction in firms' internal labor markets? And why have some countries been affected more than others? Finally, what are the implications of the age-income gaps regarding welfare, location choice, and political economy? Our work and findings are relevant to setting the stage to address those questions.

References

Acemoglu, D., D. Autor, and D. Lyle (2004): "Women, War, and Wages: The Effect of Female Labor Supply on the Wage Structure at Midcentury," *Journal of Political Economy*, 112, 497–551.

Adão, R., M. Beraja, and N. Pandalai-Nayar (2024): "Fast and Slow Technological Transitions," *Journal of Political Economy Macroeconomics*, 2, 183–227, doi:10.1086/730223.

Barra, R., B. Maître, A. McTague, and I. Privalko (2021): "Intergenerational inequality: Chapter 4 in Poverty, Income Inequality and Living Standards in Ireland," Book/report chapter 202104, ESRI and The Community Foundation for Ireland.

Beaudry, P., D. A. Green, and B. M. Sand (2014): "The Declining Fortunes of the Young since 2000," *American Economic Review*, 104, 381–86, doi:10.1257/aer.104.5.381.

Bennett, V. M. and D. A. Levinthal (2017): "Firm Lifecycles: Linking Employee Incentives and Firm Growth Dynamics," *Strategic Management Journal*, 38, 2005–2018, doi:10.1002/smj.2644.

Berry, C. and D. Sinclair (2010): "Intergenerational Fairness and the Spending Review 2010," Report, The International Longevity Centre - UK.

Bianchi, N., G. Bovini, J. Li, M. Paradisi, and M. Powell (2022): "Career Spillovers in Internal Labour Markets," *The Review of Economic Studies*, 90, 1800–1831, doi:10.1093/restud/rdac067.

Bianchi, N. and M. Paradisi (2024): "Countries for Old Men: An Analysis of the Age Pay Gap," Tech. rep.

Colombo, F., P. Aroldi, and S. Carlo (2014): ""Stay tuned": The role of ICTs in elderly life," *Active Ageing and Healthy Living: A Human Centered Approach in Research and Innovation as Source of Quality of Life*, 203, 145–156, doi:10.3233/978-1-61499-425-1-145.

Costa, D. L. (2000): "From Mill Town to Board Room: The Rise of Women's Paid Labor," *Journal of Economic Perspectives*, 14, 101–122, doi:10.1257/jep.14.4.101.

Cribb, J. (2019): "Intergenerational Differences in Income and Wealth: Evidence from Britain," *Fiscal Studies*, 40, 275–299, doi:10.1111/1475-5890.12202.

Freedman, M. (2024): "Earnings, Cohort Effects, and Inter-Generational Inequality: Evidence From the Luxembourg Income Study," *Review of Income and Wealth*, 70, 278–290, doi:https://doi.org/10.1111/roiw.12641.

Goldin, C. (2006): "The quiet revolution that transformed women's employment, education, and family," *American economic review*, 96, 1–21.

Goldin, C. and L. F. Katz (2007): "Long-run changes in the US wage structure: Narrowing, widening, polarizing," .

——— (2018a): "The race between education and technology," in *Inequality in the 21st Century*, Routledge, 49–54.

——— (2018b): *Women Working Longer: Facts and Some Explanations*, Chicago: University of Chicago Press, 11–54.

Guvenen, F., G. Kaplan, J. Song, and J. Weidner (2022): "Lifetime Earnings in the United States over Six Decades," *American Economic Journal: Applied Economics*, 14, 446–79, doi:10.1257/app.20190489.

Henehan, K., M. Gustafsson, N. Cominetti, K. Handscomb, L. Judge, J. Leslie, and L.Try (2021): "An intergenerational audit for the UK : 2021," Report, London: Resolution Foundation.

House of Lords (2019): "Select Committee on Intergenerational Fairness and Provision: Tackling intergenerational unfairness," https://publications.parliament.uk/pa/ld201719/ldselect/ldintfair/329/329.pdf.

International Monetary Fund (2006): "World Economic Outlook September 2006," https://www.imf.org/external/np/exr/ib/2000/110300.htm.

Jeong, H., Y. Kim, and I. Manovskii (2015): "The Price of Experience," *American Economic Review*, 105, 784–815, doi:10.1257/aer.20080841.

Lagakos, D., B. Moll, T. Porzio, N. Qian, and T. Schoellman (2018): "Life cycle wage growth across countries," *Journal of Political Economy*, 126, 797–849.

Levine, P. B. and O. S. Mitchell (1988): "The Baby Boom's Legacy: Relative Wages in the Twenty-First Century," *The American Economic Review*, 78, 66–69.

Luxembourg Income Study (LIS) Database (2024): "http://www.lisdatacenter.org," (multiple countries; data accessed in April 2024). Luxembourg: LIS.

Masson, A. (2021): "Intergenerational economic inequality in France. Insights and perspective," *Futuribles*, 441, 25–34, doi:10.1257/aer.99.2.45.

Maxwell, N. L. (1990): "Changing Female Labor Force Participation: Influences on Income Inequality and Distribution," *Social Forces*, 68, 1251–1266.

Miller, H., R. Meyricke, and L. Dixie (2020): "Mind the gap: the Australian Actuaries Intergenerational Equity Index-green paper," .

Naticchioni, P., M. Raitano, and C. Vittori (2016): "La Meglio Gioventù: earnings gaps across generations and skills in Italy," *Economia Politica: Journal of Analytical and Institutional Economics*, 33, 233–264, doi:10.1007/s40888-016-0034-2.

OECD (2024): "Earnings: Wage gap by age (Edition 2023)," doi:https://doi.org/https://doi.org/10.1787/3f840df4-en.

Olivetti, C. and B. Petrongolo (2016): "The evolution of gender gaps in industrialized countries," *Annual review of Economics*, 8, 405–434.

Pilipiec, P., W. Groot, and M. Pavlova (2021): "The effect of an increase of the retirement age on the health, well-being, and labor force participation of older workers: a systematic literature review," *Journal of Population Ageing*, 14, 271–315.

Raitano, M., E. Karagiannaki, T. Premrov, L. Geyer, M. Fuchs, F. Bloise, J. Costa-Font, F. Iudicone, and B. De Micheli (2021): "Study on intergenerational fairness : final report," Brussels: European commission, doi:10.2767/26828.

Rosolia, A. and R. Torrini (2007): "The generation gap: relative earnings of young and old workers in Italy," Temi di discussione (Economic working papers) 639, Bank of Italy, Economic Research and International Relations Area.

Sabater, A. and N. Finney (2023): "Age segregation and housing unaffordability: Generational divides in housing opportunities and spatial polarisation in England and Wales," *URBAN STUDIES*, 60, 941–961, doi:10.1177/00420980221121088.

Staubli, S. and J. Zweimüller (2013): "Does raising the early retirement age increase employment of older workers?" *Journal of public economics*, 108, 17–32.

vonWeizsacker, R. (1996): "Distributive implications of an aging society," *EUROPEAN ECONOMIC REVIEW*, 40, 729–746, doi:10.1016/0014-2921(95)00085-2, 10th Annual Congress of the European-Economic-Association, PRAGUE, CZECH REPUBLIC, SEP 01-04, 1995.

Welch, F. (1979): "Effects of Cohort Size on Earnings: The Baby Boom Babies' Financial Bust," *Journal of Political Economy*, 87, S65–S97, doi:10.1086/260823.

APPENDIX FOR ONLINE PUBLICATION

A Additional Information on Data Availability

TABLE IV. Data availability

				Wave 1			Wave 2			Wave 3			Wave 4			Wave 5		
Country	Group	Income	obs	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Australia	Rich	Gross	160050	✓				✓		✓				✓		✓		✓
Austria	Rich	Gross	167497	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Belgium	Rich	Gross	175398	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Brazil	Poorer	Gross	4111572	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Canada	Rich	Gross	802049	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Chile	Poorer	Net	1091258			✓			✓		✓		✓		✓		✓	
Colombia	Poorer	Gross	7915257	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Czech Republic	Rich	Gross	80831	✓			✓			✓			✓			✓		
Denmark	Rich	Gross	2463597	✓			✓			✓			✓		✓	✓	✓	✓
Estonia	Poorer	Gross	57594	✓			✓			✓			✓			✓		
Finland	Rich	Gross	104274	✓			✓			✓			✓			✓		
France	Rich	Gross	1296110	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Germany	Rich	Gross	425094	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ireland	Rich	Gross	148980	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Israel	Rich	Gross	252068	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Italy	Rich	Net	118950	✓		✓		✓		✓		✓		✓		✓		
Mexico	Poorer	Net	778487	✓	✓	✓		✓		✓		✓		✓		✓		✓
Netherlands	Rich	Gross	305908	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Norway	Rich	Gross	1618510	✓			✓			✓			✓			✓		
Paraguay	Poorer	Gross	238322	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Peru	Poorer	Gross	1062822	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Poland	Poorer	Net	1269373	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Romania	Poorer	Gross	210042			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Serbia	Poorer	Net	170404			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Slovakia	Poorer	Gross	123090	✓			✓			✓			✓	✓	✓	✓	✓	✓
Slovenia	Rich	Net	47700	✓			✓			✓		✓			✓			
Spain	Rich	Gross	443364	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sweden	Rich	Gross	340992	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Switzerland	Rich	Gross	182877			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
United Kingdom	Rich	Gross	614202	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
United States	Rich	Gross	2187365	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Uruguay	Poorer	Net	1455840	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes: The table reports the data points we include in our analysis. Countries are listed in alphabetical order. According to the algorithm described in the main text, the second column reports whether the country is classified as "richer" or "poorer". The third column provides information on whether income variables are reported as net or gross of taxes. We always calculate net income components using the reported tax variables for countries that report gross income. Each other column reports with a check mark whether the year is available for a given country. Years are grouped by wave. Each country's first and last available year are used to calculate the *GRD*.

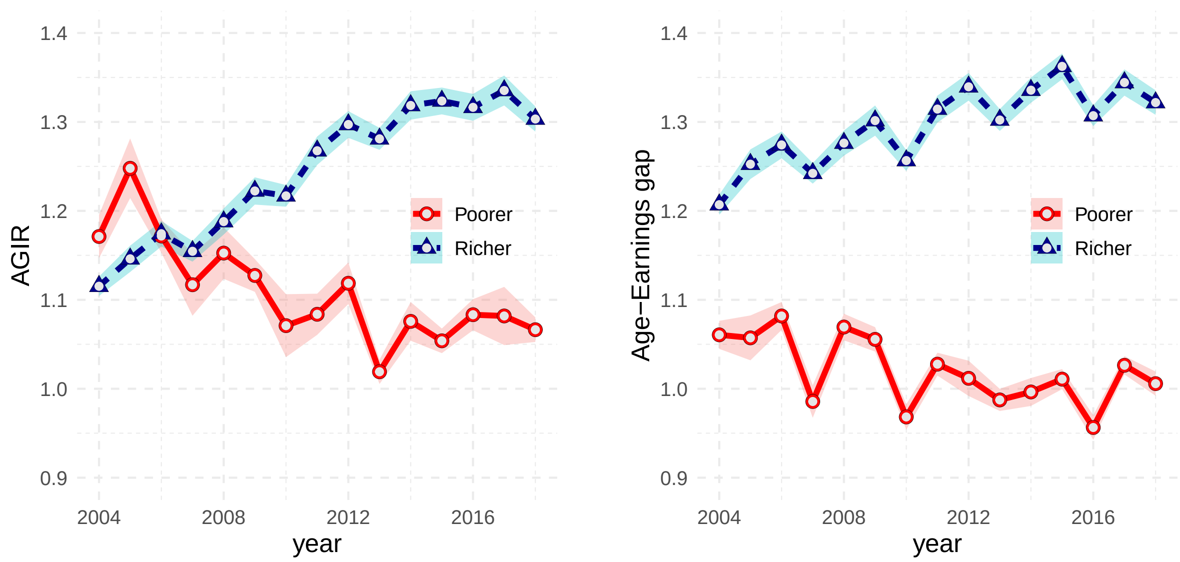
B AGIR Trends and Robustness Checks

For completeness, Figure 11 displays the AGIR and the Age-Earning Gaps when using years as the observation unit.

Figure 11. *AGIR*, 50-64 vs 25-34 years old

(a) *AGIR*

(b) Age-earnings gap



Notes: The figure depicts the Age Group Income Ratio (*AGIR*) between late-career individuals (50-64 years old) and early-career individuals (25-34 years old) in the left panel, and the age-earnings gap, the ratio between the labor earnings of similarly defined categories of employed old and young, in the right panel. The data points represent the simple average across countries of a given group (dashed blue for richer countries, solid red for poorer countries). The shaded area represents the 95 percent confidence interval of the mean of the two groups, calculated with the delta method.

B.1 Trends in Age-Earnings Gaps

In Table V, we report the same regressions using as a dependent variable the age-earnings gap. Relative to *AGIR*, the fitted trend effect of GDP on the age-earnings gap (column 2) is smaller at the top of the GDP distribution (+0.6 percent vs +1.3 percent for the richest country). Even at the 75th percentile of GDP, the time trend of the age-earnings gap is not statistically different from zero and small (+0.4 percent per year, p-value>0.05), less than half the trend in *AGIR* (+1.0 percent, p-value<0.001).

TABLE V. Trend in Earnings gap

	Wave		Year	
Dependent	ln(earnings gap)			
	(1)	(2)	(3)	(4)
[1] β: Trend	-0.004	0.002	-0.004	0.002
	(0.004)	(0.002)	(0.003)	(0.002)
[2] $\tilde{\beta}$: Trend × Richer	0.011**		0.011***	
	(0.005)		(0.004)	
[3] $\tilde{\alpha}$: Richer	0.173***		0.167***	
	(0.038)		(0.032)	
[4] θ: Initial log-GDP (Dev)		0.079***		0.108***
		(0.016)		(0.019)
[5] γ: Trend × Initial log-GDP(Dev)		0.006***		0.008***
		(0.002)		(0.002)
Observations	158	158	356	356
R^2	0.492	0.394	0.482	0.384
F-Test:[1]+[2]=0 or [1]+[5]=0	6.24	5.83	14.92	20.37
Trend effect at min GDP		-0.006		-0.009*
Trend effect at 25% GDP		-0.001		-0.002
Trend effect at 75% GDP		0.004		0.006***
Trend effect at max GDP		0.006*		0.008***

Notes: Significance level: * = 0.05, ** = 0.01, *** = 0.001. Columns (1) and (3) report the estimates of equation (2) for wave and yearly observations, respectively. Columns (2) and (4) report the estimates of Equation (3). The dependent variable is the age-earnings gap, defined similarly to *AGIR* but comparing only the labor earnings of individuals in employment. The last four rows illustrate the implied trend effect at different quantiles of GDP.

B.2 Robustness Checks

We perform several robustness checks, which corroborate the results of the first two sets of estimates. We report the results in Table VI. In columns (1) and (4), we introduce second-order terms for the initial GDP relationship, time trend, and their interaction. In columns (2) and (5), we account for the uncertainty in our estimates of the dependent variable. To do so, we estimate the model using a weighted least-square estimator, with the weights equal to the inverse of the standard errors of $\log(AGIR)$ computed with the delta method from the standard errors of each country-year (wave) average age group income. Finally, we show that the time trends in the $AGIR$ are not shared by the second moments of the income distribution, meaning that the phenomenon is not capturing a different evolution of within-group inequality. For this purpose, in columns (3) and (6), we conduct the same regression as in equation (3) by considering, as the dependent variable, the ratio of the coefficient of variations of disposable income computed for the late-career and early career individuals. This measure, denoted by *AGcvR*, captures the relative dispersion of the two distributions that account for the mean changes.[16] The data do not display any time trend in the second moments, motivating our focus on $AGIR$ rather than other measures of in-group inequalities.

Table VII provides similar robustness checks for the age-earning gap, which yields qualitatively identical results to the ones described for $AGIR$.

TABLE VI. Trend in AGIR

	Wave			Year		
Dependent	ln(AGIR)		ln(IGcvR)	ln(AGIR)		ln(IGcvR)
	(1)	(2)	(3)	(4)	(5)	(6)
[1] β: Trend	0.009	0.002	0.009	0.010	0.004**	0.002
	(0.009)	(0.003)	(0.007)	(0.006)	(0.002)	(0.004)
[4] θ: Initial log-GDP (Dev)	0.013	-0.026	0.058	0.014	-0.040	0.078
	(0.022)	(0.024)	(0.043)	(0.025)	(0.025)	(0.048)
[5] γ: Trend $\times$ Initial log-GDP(Dev)	0.009***	0.010***	-0.003	0.015***	0.015***	-0.003
	(0.003)	(0.003)	(0.007)	(0.002)	(0.003)	(0.007)
Observations	158	158	158	357	357	357
R^2	0.204	0.140	0.027	0.234	0.193	0.014
Weights	No	Yes	No	No	Yes	No
2nd order terms	Yes	No	No	Yes	No	No
F-Test:[1]+[2]=0 or [1]+[5]=0	16.69	14.31	0.34	16.69	46.26	46.26
Trend effect at min GDP	-0.007	-0.012	0.012	-0.016***	-0.018***	0.007
Trend effect at 25% GDP	0.002	-0.002	0.010	-0.002	-0.004	0.004
Trend effect at 75% GDP	0.010**	0.006*	0.008	0.012***	0.010***	0.001
Trend effect at max GDP	0.013***	0.010***	0.007	0.017***	0.015***	-0.000

Notes: Significance level: * = 0.05, ** = 0.01, *** = 0.001. All columns report the estimates of equation (3). Columns (1) and (4) use a weighted-least-squared estimator, with the weights equal to the inverse of the standard error of each country-year(wave) observation computed with the delta method. Columns (2) and (5) include the second-order terms. Finally, columns (3) and (6) use the ratio of the coefficient of variations for the two age groups of interest as the dependent variable. The last four rows illustrate the implied trend effect at different quantiles of GDP. "Weights" refers to whether observations are weighted so to give less importance to data points where the dependent variable has a large standard error. "2nd order terms" refers to whether the specification includes the squared terms of the independent variables [4] and [5].

[16] The coefficient of variation of disposable income for an age group j is the ratio of the standard deviation of disposable income for that age group divided by its average. The $AGcvR$ is the ratio of the coefficients of variation so computed for the late-career and early-career age groups.

TABLE VII. Trend in age-earnings gaps

	Wave			Year		
Dependent	ln(earnings gap) (1)	(2)	ln(EGcvR) (3)	ln(earnings gap) (4)	(5)	ln(EGcvR) (6)
[1] β: Trend	0.001	-0.0002	-0.003	0.004	0.001	-0.006**
	(0.009)	(0.003)	(0.004)	(0.006)	(0.002)	(0.003)
[4] θ: Initial log-GDP (Dev)	0.063***	0.043**	0.079**	0.117***	0.076***	0.088***
	(0.019)	(0.021)	(0.032)	(0.025)	(0.023)	(0.028)
[5] γ: Trend $\times$ Initial log-GDP(Dev)	0.006***	0.006**	-0.005	0.008***	0.008***	-0.006*
	(0.002)	(0.003)	(0.004)	(0.002)	(0.003)	(0.003)
Observations	158	158	158	356	356	356
R^2	0.414	0.255	0.053	0.386	0.331	0.039
Weights	No	Yes	No	No	Yes	No
2nd order terms	Yes	No	No	Yes	No	No
F-Test:[1]+[2]=0 or [1]+[5]=0	4.13	3.28	1.46	4.13	15.89	15.89
Trend effect at min GDP	-0.006	-0.008	0.004	-0.009*	-0.010*	0.003
Trend effect at 25% GDP	-0.001	-0.003	-0.001	-0.002	-0.003	-0.003
Trend effect at 75% GDP	0.004	0.002	-0.006	0.006***	0.005**	-0.009*
Trend effect at max GDP	0.006*	0.004	-0.007	0.008***	0.007***	-0.011*

Notes: Significance level: * = 0.05, ** = 0.01, *** = 0.001. All columns report the estimates of equation (3). Columns (1) and (4) use a weighted-least-squared estimator, with the weights equal to the inverse of the standard error of each country-year(wave) observation computed with the delta-method. Columns (2) and (5) include the second-order terms. Finally, columns (3) and (6) use the ratio of the coefficient of variations for the two age groups of interest as the dependent variable. The last four rows illustrate the implied trend effect at different quantiles of GDP. "Weights" refers to whether observations are weighted so to give less importance to data points where the dependent variable has a large standard error. "2nd order terms" refers to whether the specification includes the squared terms of the independent variables [4] and [5].

B.3 AGIR and Household-level Benefits

Some benefits are paid at the household level, rather than at the personal level. Hence, they do not enter in our baseline personal income definition. In this section, we allocate these household-wide benefits to the households' members, and compare the resulting AGIR with our baseline figures.

We add three categories of household-wide benefits: i) child benefits, ii) general assistance (such as minimum income integrations, or universal benefit systems), and iii) housing benefits (such as rent subsidies).

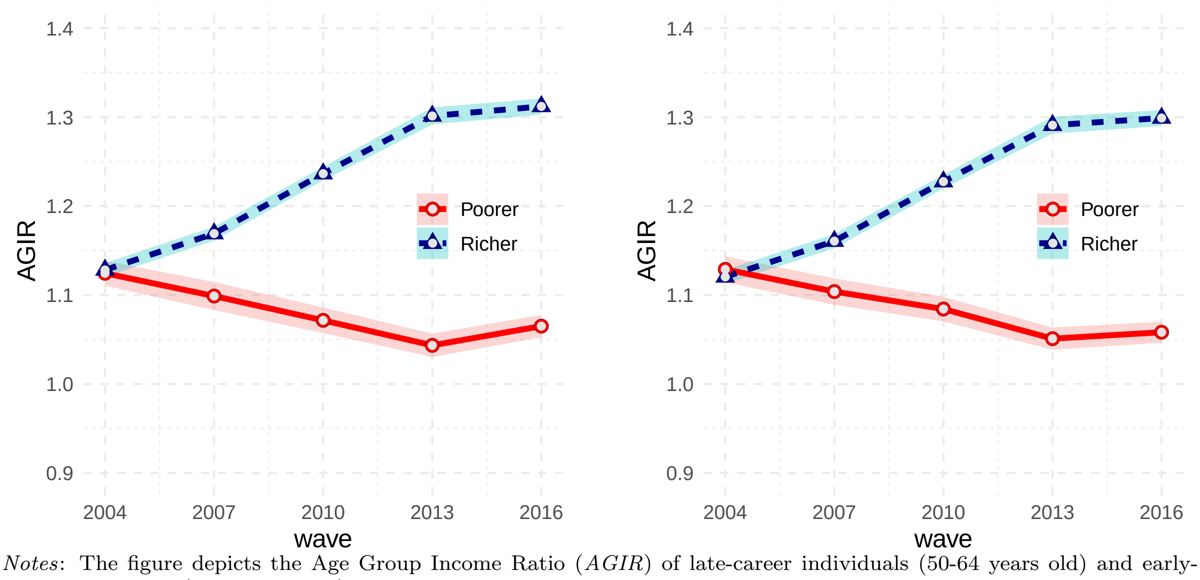
Children benefits are allocated to individuals proportionally to the number of own children who live in the household. For example, in an household with two parents with one small child (who generates a child benefit) and one adult child (who does not), we allocate 50% of the child benefit to each of the parent, and zero to the adult child. The reason is that if the adult child moved out of their household, they would not receive any child benefit of their own. General assistance and housing benefits are split among all adults in the household, with equal weight. Since not all countries report all benefits types in each year, we remove those benefits that are not resported throughout the whole sample of a country.[17]

We plot the two statistics side-by-side in Figure 12. Since more young individuals (25-34 years old) are renters and have children, a large share of household benefits accrues to young individuals. Hence, the level of AGIR is slightly smaller when accounting for these benefits (1 pp. smaller in richer countries in 2004). However, the trend is virtually unaffected: between 2004 and 2018, the AGIR with household benefits fell by 0.2 percentage points less than the baseline figure in poorer countries (out of 6.1), and 0.3 less in richer ones (out of 18.5).

Hence, we conclude that - on average - household-level benefits are only slightly age-biased in favour of the young,[18] and such bias had not substantially changed over time.

Figure 12. *AGIR*, 50-64 vs 25-34 years old

(a) *AGIR* (b) AGIR + Household Benefits



Notes: The figure depicts the Age Group Income Ratio (*AGIR*) of late-career individuals (50-64 years old) and early-career individuals (25-34 years old) in the left panel. The right panel displays a similar statistic, calculated by attributing to each individual household-level benefit payments. The data points represent the simple average across countries of a given group (dashed blue for richer countries, solid red for poorer countries). The shaded area represents the 95 percent confidence interval calculated with the delta method.

[17] These are child benefits for Australia, Belgium, Denmark and Poland. Housing benefits for Australia, Israel, Slovakia and Switzerland. General assistance for Denmark, France, Paraguay, and Uruguay.

[18] Exceptions are Denmark and Germany, where accounting for household-level benefits reduce AGIR by 4-5 percentage points. The trend remains unaffected.

C Growth Rate Differentials

C.1 GRD and AGIR

To unravel the relationship between age group income growth and the evolution of the income ratio $R(t)$, let us define the change in $AGIR$ between period T and $T+h$ as:

$$\Delta R \equiv R(T+h) - R(T).$$

Using the notion of age group income growth, we obtain

$$\begin{aligned}\Delta R &= \frac{y_{\text{old},T}(1+g(y_{\text{old}}))}{y_{\text{young},T}(1+g(y_{\text{young}}))} - \frac{y_{\text{old},T}}{y_{\text{young},T}} \\ &= R(T)\left(\frac{1+g(y_{\text{old}})}{1+g(y_{\text{young}})} - 1\right).\end{aligned}$$

Rearranging, we have:

$$\frac{\Delta R}{R(T)} = \frac{g(y_{\text{old}}) - g(y_{\text{young}})}{1+g(y_{\text{young}})}.$$

Then, for small $g(y_{\text{young}})$, the annualised income growth rates differential $g(y_{\text{old}}) - g(y_{\text{young}})$ approximates the annualised growth rate of the income ratio $R(T)$:

$$GRD \equiv \frac{1}{h}\left(g(y_{\text{old}}) - g(y_{\text{young}})\right) \approx \frac{1}{h}\frac{\Delta R}{R(T)}.$$

D GRD Across Demographics

In this section, we display the overall *GRD* decomposition of the different demographic subsets considered in section 4.

D.1 Retirement Age definition

First, we describe the data sources for our definition of retirement age at the beginning of the sample. The thresholds, for males and females when different, are presented in Table VIII together with a link to the source datasets. All the retirement ages are based on either OECD's Pension at a Glance 2005 report or the U.S. Social Security Administration "Social Security Programs Throughout the World" publication closest to 2004 (2004 for Europe and Asia, 2005 for Americas). Where available, we pick the "early" retirement age. This represents the minimum retirement age for individuals with a long enough contribution history, or willing to accept lower replacement rates. This aims to capture the retirement age generally attainable by any individual. For this reason, we do not account for special regimes for particular occupations or exceptions for very early career starts.[19] Finally, recall that it is always possible to retire earlier than the legal minimum retirement age. The minimum retirement age defines the age at which it is possible to claim public pensions (and, in some cases, tax-free regimes on private pensions), but a worker may decide to retire earlier on private funds (or other non-old age benefits).

We make four minor discretionary adjustments. First, we set the minimum retirement age in our sample to 53 years old to avoid reducing our sample size for the old group (normally defined as 50-64 years old) too much. This choice affects only the female retirement ages for Serbia and Peru, where the female minimum retirement age was 50 in 2004. Second Czech Republic set the minimum retirement age for women to 60, minus a discounts for each child. Thus, we set the female retirement age at 58, the approximate retirement age for women with two children. Third, Israel introduced a pension reform in late 2004. Since most individuals surveyed in 2004 retired under the previous regime,

[19]For example, France provides some opportunities to retire at 56 y.o. for individuals who started working at age 17 and have a sufficiently long contribution history. Several countries, such as Italy, provide early retirement opportunities for individuals in physically-heavy occupations.

and the new regime only slowly increased the retirement age over time, we take as reference the early-2004 regime (65 years for men, 60 for women). Finally, Brazil had no minimum retirement age in 2004 but a minimum social security payment record (35 years for men, 30 for women). We thus pick 55 and 53 years old as reasonable early retirement ages for individuals who started working at around 18 years old and experienced a few employment/contribution gaps.

TABLE VIII. Retirement Age

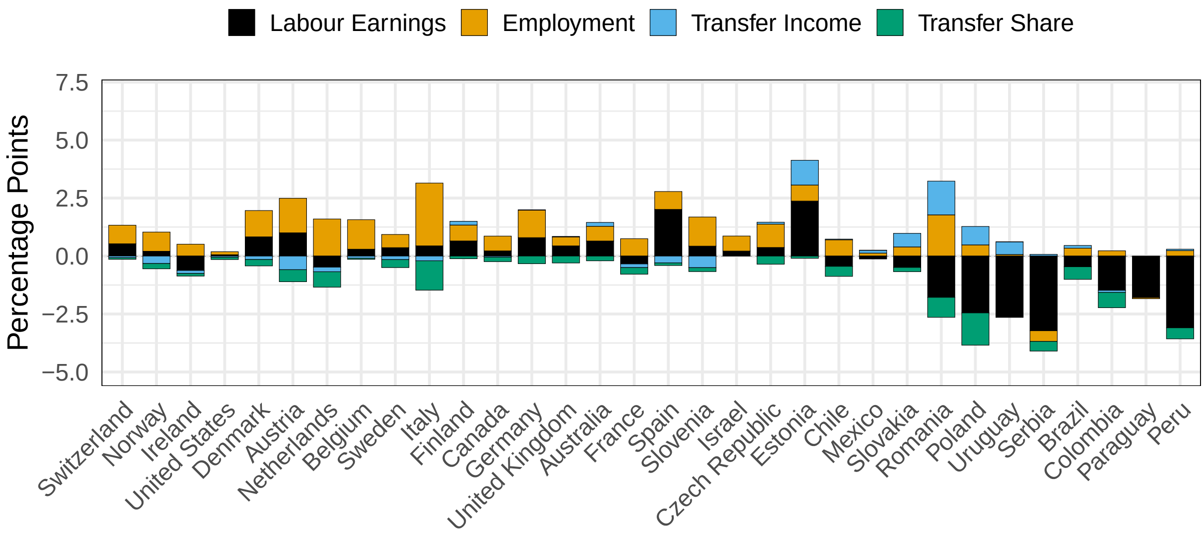
Country	Males	Females	Year	Source
Australia	55	55	2005	OECD, Pension at a glance 2005
Austria	65	60	2005	OECD, Pension at a glance 2005
Belgium	60	60	2005	OECD, Pension at a glance 2005
Brazil	55	53	2004	(a)
Canada	60	60	2005	OECD, Pension at a glance 2005
Chile	65	60	2008	Social Security Adm., SSPTW Americas 2004
Colombia	62	57	2004	Social Security Adm., SSPTW Americas 2004
Czech Republic	60	58	2005	OECD, Pension at a glance 2005
Denmark	65	65	2005	OECD, Pension at a glance 2005
Estonia	63	59	2004	Social Security Adm., SSPTW Europe 2004
Finland	60	60	2005	OECD, Pension at a glance 2005
France	60	60	2005	OECD, Pension at a glance 2005
Germany	65	63	2005	OECD, Pension at a glance 2005
Ireland	65	65	2005	OECD, Pension at a glance 2005
Israel	65	60	2004	Social Security Adm., SSPTW Asia 2004
Italy	60	60	2005	OECD, Pension at a glance 2005
Mexico	65	60	2005	OECD, Pension at a glance 2005
Netherlands	60	60	2005	OECD, Pension at a glance 2005
Norway	67	67	2005	OECD, Pension at a glance 2005
Paraguay	55	55	2005	Social Security Adm., SSPTW Americas 2005
Peru	55	53	2005	Social Security Adm., SSPTW Americas 2005
Poland	65	60	2005	OECD, Pension at a glance 2005
Romania	55	55	2004	Social Security Adm., SSPTW Europe 2004
Serbia	53	53	2004	Social Security Adm., SSPTW Europe 2004
Slovakia	62	62	2005	OECD, Pension at a glance 2005
Slovenia	63	60	2004	Social Security Adm., SSPTW Europe 2004
Spain	60	60	2005	OECD, Pension at a glance 2005
Sweden	61	61	2005	OECD, Pension at a glance 2005
Switzerland	63	62	2005	OECD, Pension at a glance 2005
United Kingdom	65	65	2005	OECD, Pension at a glance 2005
United States	62	62	2005	OECD, Pension at a glance 2005
Uruguay	60	60	2005	Social Security Adm., SSPTW Americas 2005

(a) Brazil had no minimum retirement age in 2004, but anybody with 35 (males) or 30 (females) years of contribution was allowed to retire. We pick 55 (males) and 53 (females) to reflect a reasonable working life of non-college workers with some social security contribution gaps.
Notes: The table reports the retirement age used to limit the sample size in Section 4 in the main text and other results in this Appendix. The retirement age is intended, where available, as the "early" retirement option, as listed by either the OECD or the U.S. Department of Social Security in their reports. The "Reference Year" column indicates the year the data have been collected. This means all the retirement ages are correct for that year but may have been in place for longer. In the final column, we link the sources we used to compile the table. We set a minimum retirement age of 53 to have enough observations in our old (50+) age group.

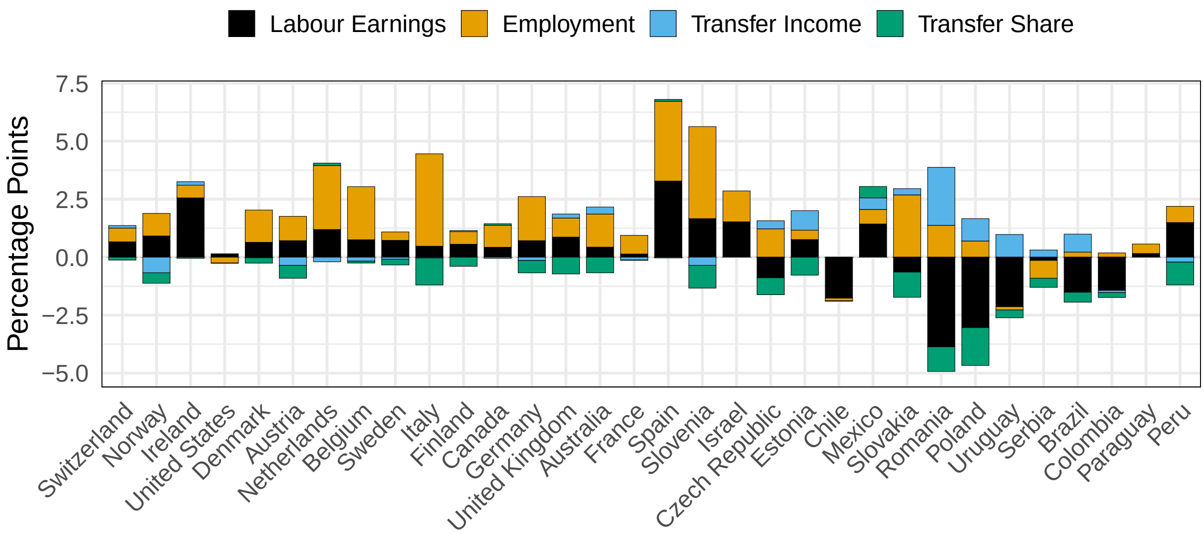
D.2 GRD decomposition by demographic

Figure 13. GRD decomposition: Male and Female

(a) Male



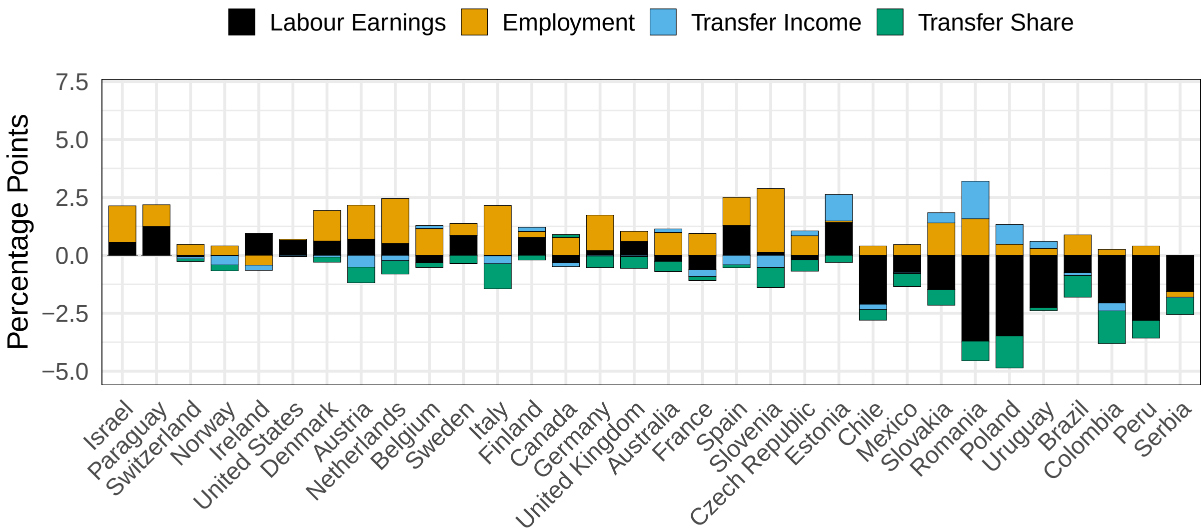
(b) Female



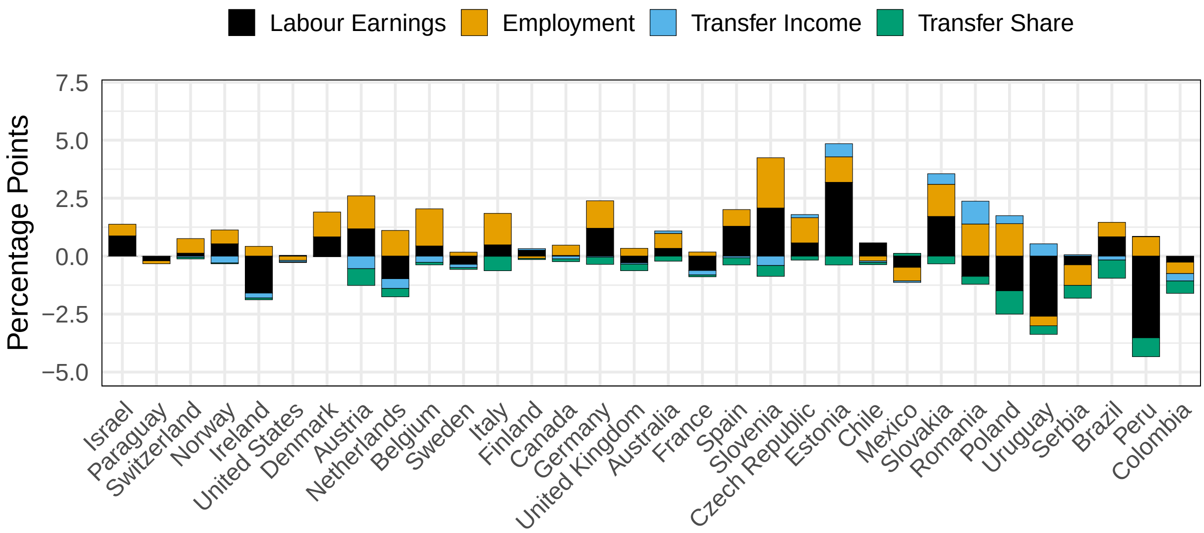
Notes: panel (a) depicts the employment contribution (lighter red bar) to the *GRD*s for male late-career individuals (50-64 y.o.) and male early-career individuals (25-34 y.o), and the labor earnings contribition (black bar). Panel (b) depicts the two contributions for female.

Figure 14. Labor income decomposition: Non-College and College Educated

(a) No College



(b) College graduates

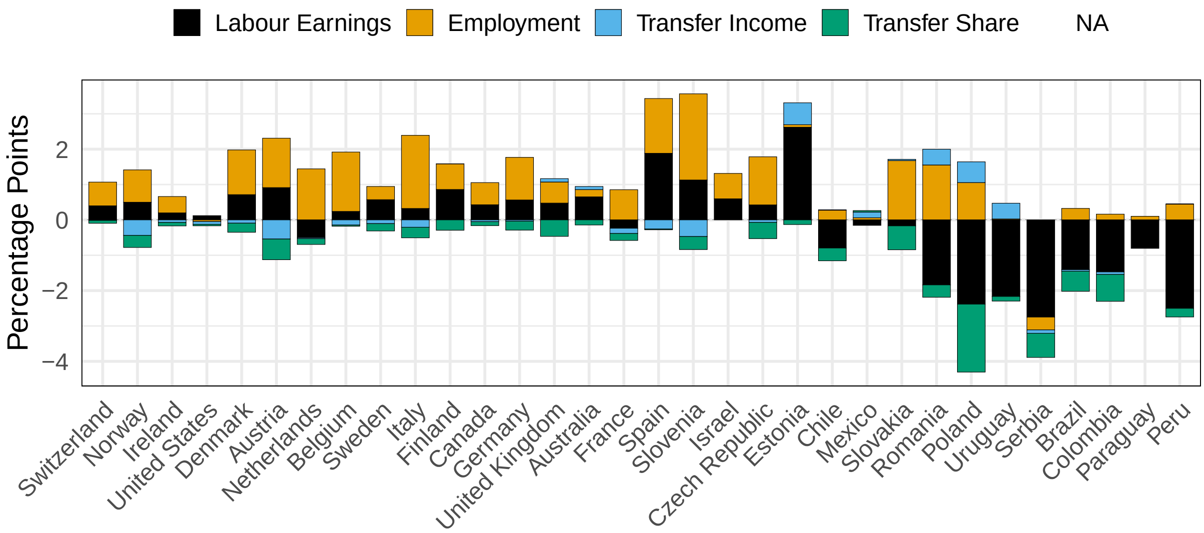


Notes: panel (a) depicts the employment contribution (lighter red bar) to the *GRD*s for non-college-educated late-career individuals (50-64 y.o.) and non-college-educated early-career individuals (25-34 y.o) and the labor earning contribution (black bar). Panel (b) depicts the two contributions for college-educated individuals.

Figure 15. GRD decomposition: all individuals and below retirement age only

(a) All individuals

(b) Below retirement age



Notes: panel (a) depicts the employment contribution (lighter red bar) to the *GRD*s for all late-career individuals (50-64 y.o.) and early-career individuals (25-34 y.o), and the labor earning contribution (black bar). Panel (b) depicts the two contributions for individuals below the minimum old-age pension retirement age. Retirement age is defined according to the prevailing legislation at the beginning of our sample, differentiation between countries, and - where necessary - gender.